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A STUDY TO IDENTIFY OPPORTUNITIES FOR INCREASED SOLID WASTE UTILIZATION. VOLUME I

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16. Abstracts

This study concerns the development of greater solid waste utilization through analysis of the secondary materials industry, its sources of supply, its consuming markets, and its economic and technological problems. Eight separate materials and a general report are included. The materials examined are aluminum, copper, lead, zinc, nickel and stainless steel, precious metals, paper, and textiles. Problems inhibiting increased recycling of these materials are identified, and recommended actions are proposed. A survey of the secondary materials industry was the basis for many of the identified problems and also provided numerous statistics on the scrap industry.

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NOTICE

This report is one of a series of 9 volumes on the recycling of solid waste materials:

Volume	Materials Covered
I	General Report
II	Aluminum
III	Copper
IV	Lead
V	Zinc
VI	Nickel and Stainless Steel
VII	Precious Metals
VIII	Paper
IX	Textiles

Volume I provides a brief summary of the other 8 volumes, plus an analysis of activities and recycling problems common to all of the commodities. Areas of commonality include such matters as legislation and its effect on recycling, and a description of the equipment used in processing secondary materials. It also presents a statistical profile of that portion of the secondary materials industry studied. For more specific detail on the individual commodities, the reader may wish to review the other volumes of interest.

(10)

PROLOGUE

The Office of Solid Waste Management, Environmental Protection Agency, is keenly aware of the increasing volume of solid wastes being generated in the United States. The increasing difficulties and costs of disposing of solid waste materials makes it imperative that a larger proportion of materials be recovered from the solid waste channels and recycled. As a part of a broad program to identify opportunities for increased recycling of secondary materials the Office of Solid Waste Management is studying major industries that generate large quantities of solid wastes and is studying the industries that collect, sort, and reuse portions of these solid waste streams. The study herein described was designed to take advantage of the previous and concurrent studies supported by the Office of Solid Waste Management and fit into those studies information on the secondary materials industries and their potentialities to effect increased collection, processing, and recycling of materials.

There are several basic underlying motivations behind the need for a study of solid waste utilization. (1) The utilization of waste materials represents a conservation of natural resources. (2) Any type of unused solid waste represents a form of pollution; yet if a method for recycling it can be developed, it represents an economic means for controlling man's environment. (3) The importance of the resource value of secondary materials is evident when one considers that the viability of many businesses is dependent on the maximum economic use and recovery of all material values. This is true not only in regard to the optimum use of virgin raw materials, but the recoverability of these materials when the useful life of the object is ended. These recoverable values make it possible for many materials to compete with others whose initial cost may be less.

This report has been reviewed by the U.S. Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of commercial products constitute endorsement or recommendation for use by the U.S. Government.

A STUDY TO IDENTIFY OPPORTUNITIES FOR INCREASED SOLID WASTE UTILIZATION

Volume I: General Report

This report (SW-40d.1) on work performed under
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Book 2, which consists of Volumes II to VII	*Aluminum Report, Copper Report, Lead Report, Zinc Report, Nickel and Stainless Steel Report,* and *Precious Metals Report* (SW-40d.2) is available from the Department of Commerce, National Technical Information Service, Springfield, Virginia.
Book 3, which consists of Volumes VIII and IX	*Paper Report* and *Textile Report* (SW-40d.3) is available from the Department of Commerce, National Technical Information Service, Springfield, Virginia.

U.S. ENVIRONMENTAL PROTECTION AGENCY

1972

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This report and the others in the series were made possible by the cooperation of a large number of people. Those who gave this help include:

- The owners and managers of a large number of recycling companies who discussed the industry with Battelle researchers
- The people at hundreds of recycling companies who completed and returned the Industry Census questionnaires
- The managers and specialists of many users of materials--both primary and recycled--and generators of scrap who discussed recycling from their individual points of view
- The personnel of trade associations, trade publishers, and other service groups who advised the researchers
- The staff members of NASMI who provided guidance, criticism, and encouragement to the research team
- The members of the NASMI commodity committees who provided insight and information without which meaningful results would have been difficult or impossible
- The staff of World Wide Information Service, Inc., who interviewed a large number of recycling companies for the industry census.

(5)

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EXTENSIVE SURVEY DATA

Secondary materials products command attention by the sheer magnitude of their importance as a portion of the total raw material supply. Scrap lead accounts for more than 50 percent of the total raw material used in the manufacture of new products. Aluminum scrap represents about 30 percent: gold scrap represents 25 percent of the total required for industrial uses, and in jewelry more than 50 percent. In the case of paperstock, waste material products represent about 25 percent of new supply, and in copper and brass, scrap represents almost 50 percent of the raw materials required. In spite of the impressive quantities of these materials that are currently recycled, large volumes of these kinds of nonferrous materials are generated in forms difficult and costly to collect and process, and hence add to the problems of solid waste disposal. Such disposal represents waste of natural resources as well as added costs to society.

The secondary materials industries, not unlike any other business in the country today, are being subjected to a number of technical-socio/political-economic forces that will require change on the part of the industry. Some of the technical forces at work include: the development and usage of higher performance materials and special purpose equipment. For example, composite materials such as plastic on metal, combinations of dissimilar metals, polymers on fibers, and polymeric fiber combinations are meeting the growing need for "engineered" materials. Automation is dictating many changes in materials, particularly in the need for higher quality, more uniform materials. The fabrication of equipment, motors, engines, etc., is requiring new forms of metals and alloys. Factory built homes will also require new and different combinations of materials, and such production methods require more uniform input material which in turn means tighter material specifications. New production processes, which are being introduced--electrochemical machining, for instance--change the nature of the secondary material available for reprocessing or disposal. The fragmentation of scrap which has been in use only for the last half dozen years is one of the technical changes in the secondary materials industry that enables processors to produce upgraded secondary metals.

Socio/political forces are having and will continue to have an important effect on the secondary materials industries. The need for better pollution control is increasingly evident and results are being demanded. Aesthetic values must be considered in laying out processing plants. The continuing need for the most economic utilization of land and the growth of most urban areas is also having its effect on the secondary materials industries. Urban renewal programs are limiting the location sites available to secondary material processors or are forcing location changes. Changing social values are having an effect on the ability of processors to obtain the necessary labor.

Economic forces having an impact on industry include: the rising minimum wage levels, increased imports of both materials and end-products, and increased transportation costs. Growing volumes of waste materials that must be handled introduce problems in collection, transportation, and processing. In addition, since labor costs are increasingly difficult to control there is an even greater need on the part of secondary materials processors to find mechanized processes for handling, sorting, and upgrading raw wastes to usable products.

Prior to this study no comprehensive survey or analysis of the entire secondary materials industries had been made. In view of the number of problems facing the secondary materials industries, and the economic importance of these industries, there was an imperative need for such a survey and analysis. It was recognized that any program designed to increase the utilization of secondary materials had to take into account the present practices and potentialities of the secondary materials industries most intimately involved with the current technology and art of recycling of waste materials. A comprehensive study of the industries also had to include an examination of their structure, their combined size, and their relationships with suppliers of waste materials and the users of secondary material products. Identification of the problems these industries face in the collection, processing, and marketing of reclaimed materials (and the similarity to and the interrelationship with supplier and user problems) was essential. It was expected that the analysis and study of those problems in a creative way would point to opportunities for greater solid waste utilization through the expansion of the present mechanisms and institutions.

SUMMARY

The Office of Solid Waste Management, Environmental Protection Agency, has as a major function the formulation and recommendation of Federal Government policies which seek to alleviate and control pollution of the environment by solid wastes. The Office recognizes that the recycling of solid wastes--the recovery of materials of value--can be a highly desirable way to prevent environmental pollution by these wastes. In order to develop a basis for planning, the Office established a grant program with the National Association of Secondary Material Industries, Inc. (NASMI). The Association, in turn, asked Battelle's Columbus Laboratories to assist it in (1) providing the Office of Solid Waste Management with a profile of the secondary materials industry, (2) identifying obstacles to the recycling of solid wastes, and (3) recommending directions for investigation and research to overcome these obstacles. Eight commodities were selected for study. They included aluminum, copper, lead, zinc, nickel (including stainless steel), precious metals, paper, and textiles.

The NASMI membership is representative of an industry that for many decades has effectively and economically recycled solid waste materials, but recently additional dimensions have been added to the traditional economic environment in which the industry has operated. Increased national concern with the improvement of the living environment and natural resource conservation is not only raising new challenges for the recycling industry, but is providing new opportunities as well.

Governmental influence on solid waste utilization and recycling is substantial and is effected through such means as export regulations, transportation

rates, specifications for purchased materials, zoning restrictions, and pollution control regulations. The Solid Waste Disposal Act and the Resource Recovery Act of 1970 recognize and emphasize the importance of Government policies on solid waste utilization and do give a forward thrust to the promotion of the recycling concept.

The period since the initiation of this subject study in June of 1970 has seen a large number of varied activities illustrative of changing attitudes on the part of Government, industry, and the general public. As examples, can collection programs are underway, NASMI has been instrumental in getting the Federal Government and municipal governments to revise their purchase specifications for paper and other products, and President Nixon recently established the National Commission on Materials Policy as discussed in the Resource Recovery Act of 1970.

It is in this period of flux that the results of the subject study can be of greatest value in that it identifies the many complex factors involved in the recycling of solid wastes. It is apparent that any program to effect increased recycling must consider the complete recycling network.

The Recycling Industry

The recycling industry is making a major contribution to the nation's economy as evidenced by the value of the secondary materials consumed annually. As shown in Table I, more than $3.25 billion of the selected recycled materials were consumed in 1969. Copper and its alloys represented almost one-half of this value but paper accounted for the greatest tonnage volume by far.

The scrap processor is the vital link in the recycling process as depicted in Figures I and II. In the case of metals the manufacturer group converts intermediate cast and wrought products into consumer goods. In the process, wastes

TABLE I. CONSUMPTION OF SELECTED RECYCLED MATERIALS, 1969

Material	Consumption (short tons)	Value (dollars)
Aluminum	1,056,000	553,000,000
Copper and copper alloys	1,489,000	1,460,000,000
Lead	585,000	175,000,000
Zinc	182,000	53,000,000
Nickel and nickel alloys	80,000	209,000,000
Precious metals	79,000,000 troy ounces	487,000,000
Paper	11,400,000	250,000,000
Textiles	1,400,000	84,000,000
TOTAL		3,271,000,000

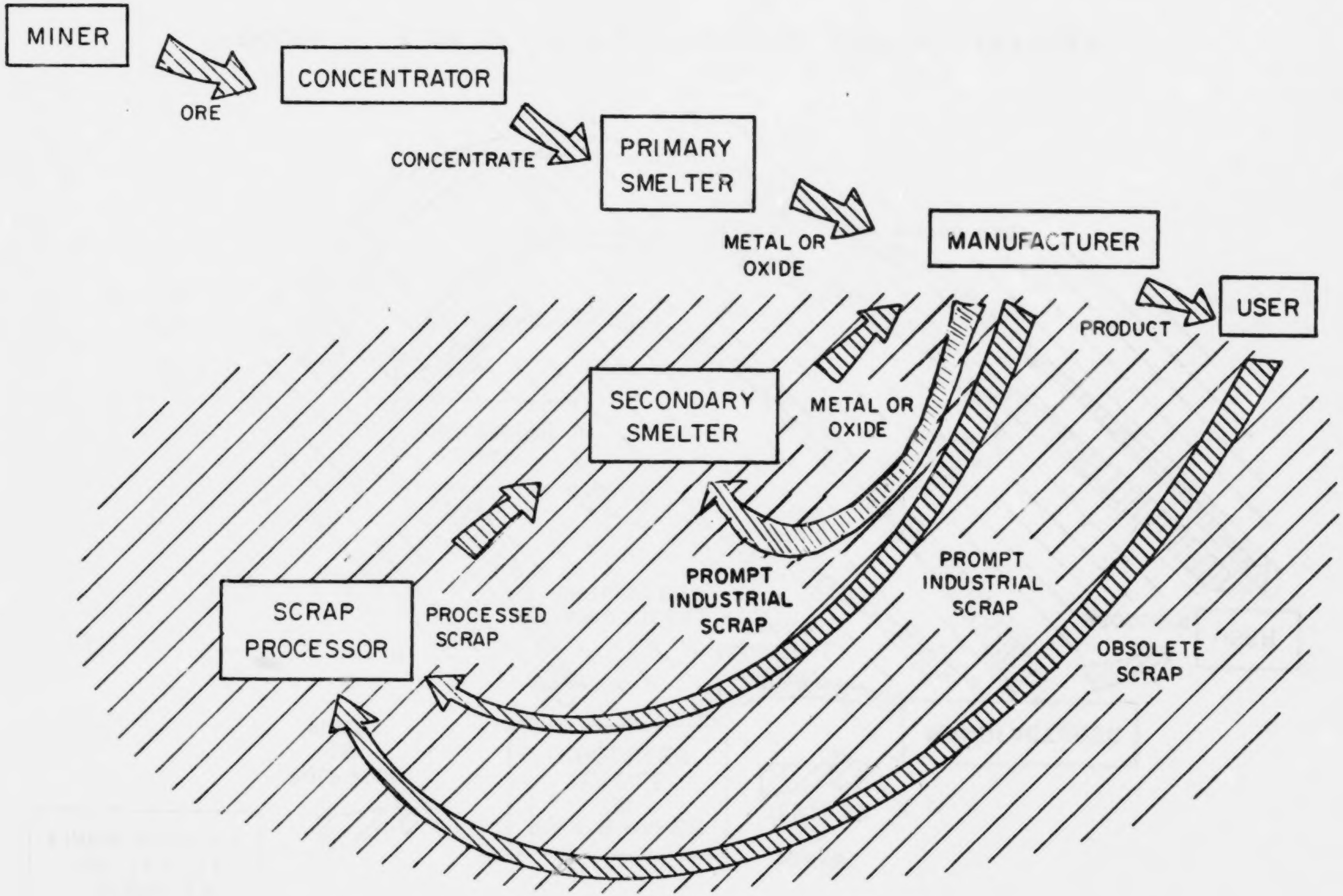
MINER
ORE
CONCENTRATOR
CONCENTRATE
PRIMARY SMELTER
METAL OR OXIDE
MANUFACTURER
PRODUCT
USER
SECONDARY SMELTER
METAL OR OXIDE
PROMPT INDUSTRIAL SCRAP
PROMPT INDUSTRIAL SCRAP
OBSOLETE SCRAP
PROCESSED SCRAP
SCRAP PROCESSOR

FIGURE I. FLOW OF PRIMARY AND RECYCLED METALS

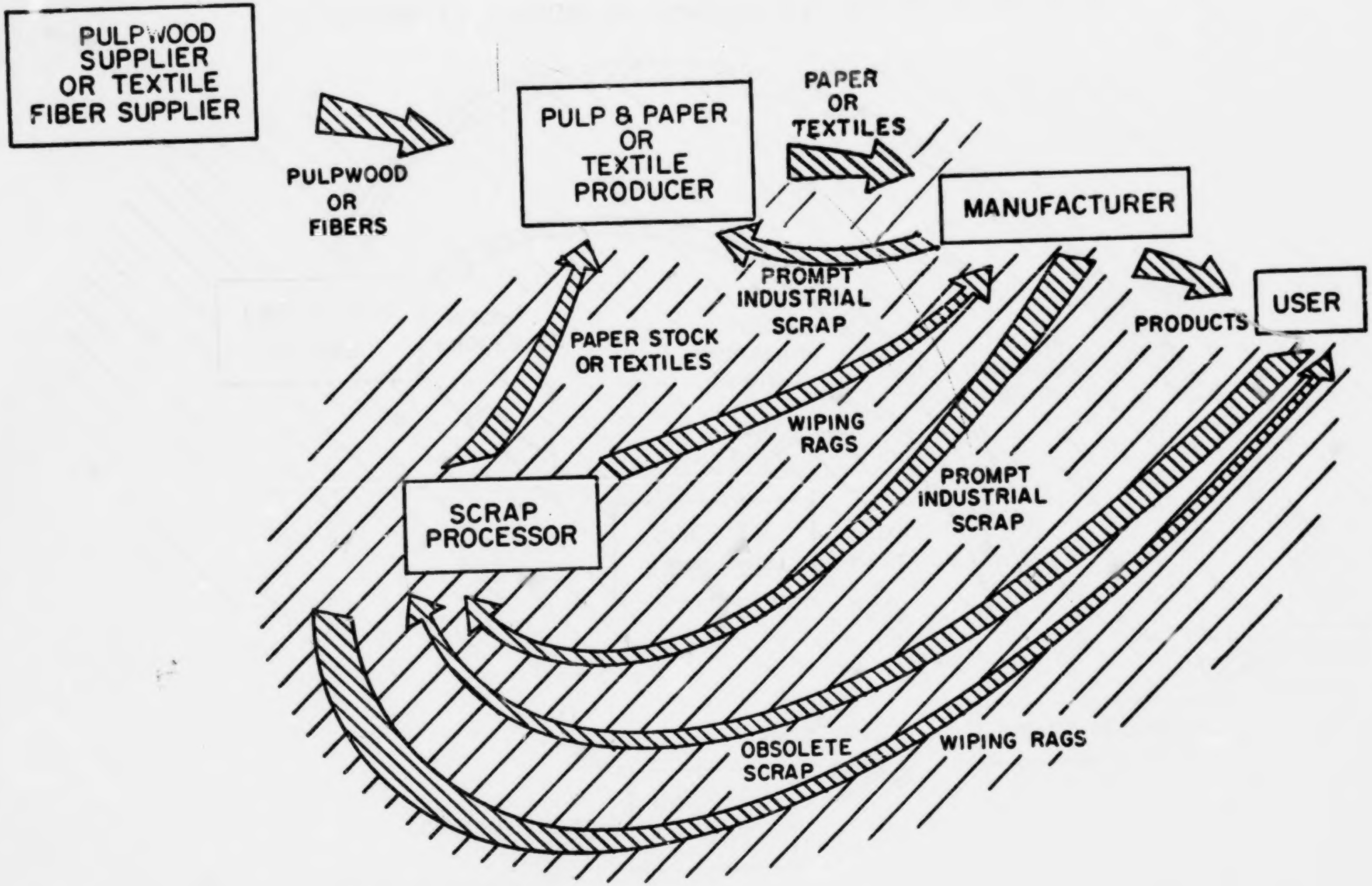
PULPWOOD SUPPLIER OR TEXTILE FIBER SUPPLIER
PULPWOOD OR FIBERS
PULP & PAPER OR TEXTILE PRODUCER
PAPER OR TEXTILES
MANUFACTURER
PRODUCTS
USER
PROMPT INDUSTRIAL SCRAP
PAPER STOCK OR TEXTILES
WIPING RAGS
PROMPT INDUSTRIAL SCRAP
SCRAP PROCESSOR
OBSOLETE SCRAP
WIPING RAGS

FIGURE II. FLOW OF VIRGIN AND RECYCLED PAPER AND TEXTILES

are generated and these are classed as prompt industrial scrap.(1) Wastes represented by goods discarded by the users are appropriately called obsolete scrap. Both types flow through the scrap processor for sorting and preparation into a raw material form most suitable for reuse by the secondary smelter and refiner. Some prompt industrial scrap is returned by manufacturers directly to the primary metal producer, and the amounts vary from metal to metal. Obsolete scrap may also revert directly to the primary smelter as exemplified by current aluminum can collection programs.

The flow of paper and textiles is largely analogous to that of metals with the one important exception that wiping rags are shipped to both the manufacturer and user groups.

The extensive survey of the recycling industry conducted by NASMI and Battelle-Columbus as part of the study program elicited responses from 578 firms. The survey discloses that the average recycling company, that is, one engaged in the collection, processing, conversion, and sale of the selected solid waste materials, is a substantial operation. As shown in Table II, average annual sales exceed $7.5 million and the average company employs 71 persons. As indicated in the Appendix, almost 10 percent of the dealer/processors have more than 150 employees. Many companies, almost 31 percent of the total respondents have more than 50,000 square feet of plant under roof, and over 15 percent have more than $2 million invested in plant and equipment.

Geographic distribution of recycling industry establishments by census region are shown in Figure III. As expected, concentrations are evident in the populous, highly industrialized areas of the Northeast and West Coast. Thirty percent are located in the New York, Pennsylvania, and New Jersey area.

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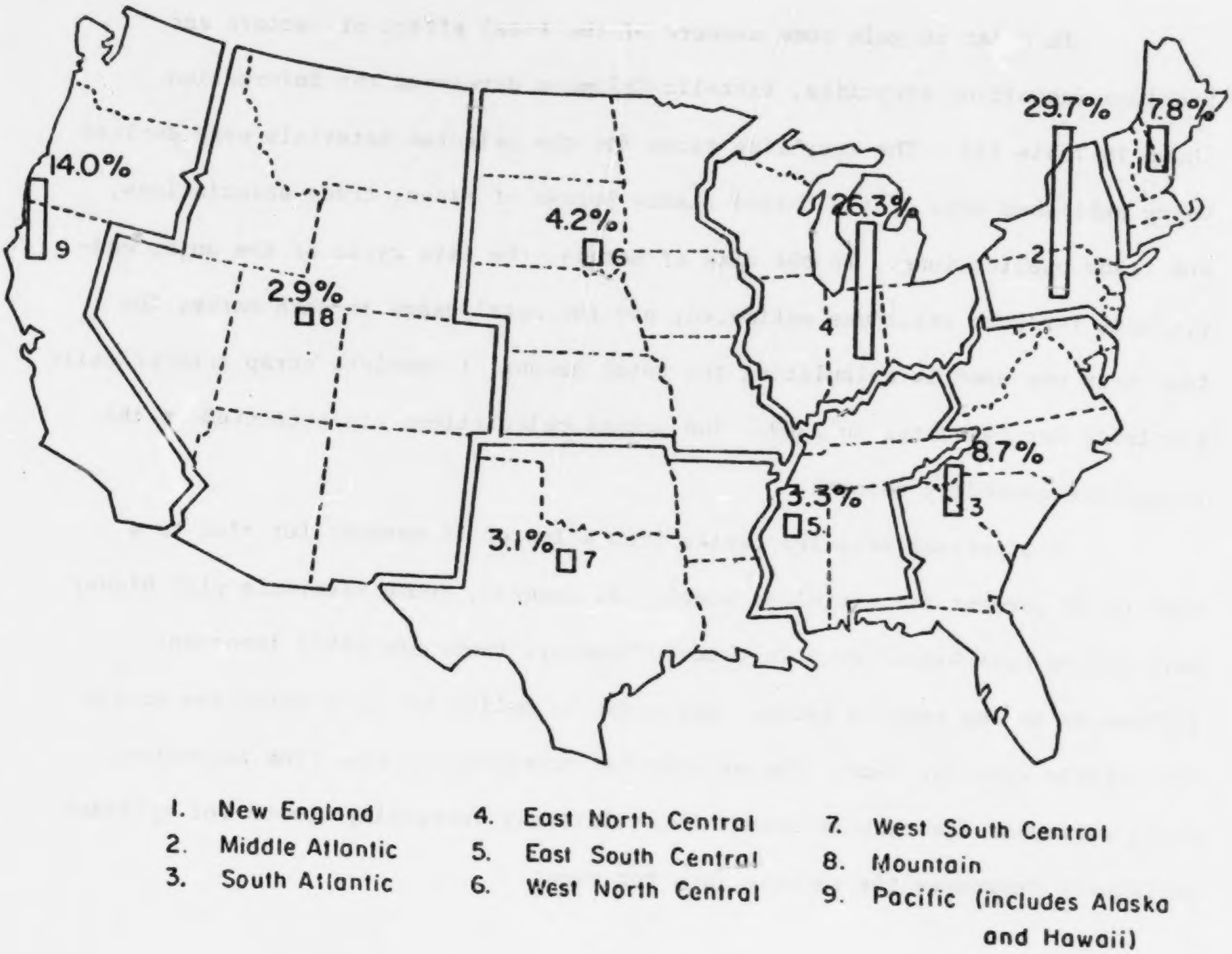
(1) Home scrap--that generated and used in the same plant--is not included as part of the materials entering the recycling industry.

(20)

TABLE II. SELECTED DATA, RECYCLING INDUSTRY COMPANIES

Average annual sales	$7,540,000
Average number of employees	71
Average value of plant and equipment	1,480,000
Average investment per employee	20,800
Average annual sales per employee	106,000
Average investment per dollar of sales	5 cents

Source: Extensive Survey



29.7%
7.8%
14.0%
26.3%
4.2%
2.9%
8.7%
3.3%
3.1%
1
2
3
4
5
6
7
8
9
1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

FIGURE III. GEOGRAPHIC DISTRIBUTION OF THE RECYCLING INDUSTRY BASED ON NUMBER OF ESTABLISHMENTS
Source: Extensive Survey

Recycling Problems of Specific Commodities

In order to gain some measure of the total effect of factors and problems inhibiting recycling, Battelle-Columbus developed the information shown in Table III. The recycling rates for the selected materials were derived using published data of the United States Bureau of Mines, trade associations, and trade publications. In the case of metals, the life cycle of the major end-products for each metal was estimated, and the metal usage in each market for that year was used in calculating the total amount of obsolete scrap theoretically available for recycling in 1969. The actual calculations are presented in the respective commodity reports.

The percent recycled varies from a low of 14 percent for zinc to a high of 88 percent for stainless steel. In general, those materials with higher unit prices have higher recycle rates. However, there are other important influences on the recycle rates. The trade-in policy for auto batteries boosts the recycle rate for lead. The sacrificial corrosion of zinc from galvanized steel depresses its recycle rate. The relatively decreasing demand for cylinder paperboard depresses the recycle rate for paper.

TABLE III. RECYCLING RATES FOR SELECTED MATERIALS, 1969

Material	Short Tons[1] Available for Recycling, 1969	Short Tons Recycled, 1969	Percent Recycled, 1969	Short Tons **Not** Recycled, 1969
Aluminum	2,215,000	1,056,000	48	1,159,000
Copper	2,456,000	1,489,000	61	967,000
Lead	1,406,000	585,000	42	821,000
Zinc	1,271,000	182,000	14	1,089,000
Nickel	106,000	42,200	40	63,900
Stainless Steel	429,000	378,000	88	51,000
Precious Metals[2]	105,000,000 troy ounces	79,000,000 troy ounces	75	26,000,000
Paper	48,200,000	11,400,000	24	36,800,000
Textiles	3,200,000	1,400,000	44	18,000,000

Note: (1) Battelle-Columbus estimates. See specific commodity reports Volumes 2-9 for methodology.

(2) Includes:

	Troy Ounces Available	Troy Ounces Recycled	Troy Ounces **Not** Recycled
Gold	2,200,000	1,800,000	400,000
Silver	100,000,000	75,000,000	25,000,000
Platinum	2,300,000	2,200,000	100,000

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General Recycling Problems

Problems peculiar to each of the commodities studied and problems that are largely general in nature and pertinent to all or most of the commodities were identified in this study. The problems listed in this report were generally those which were identified by the secondary materials firms interviewed and by the special committee of NASMI members which met with Battelle. Table IV identifies and analyzes the five high-priority general problems of recycling identified by these groups. These problems involve irrational or discriminatory purchase specifications that preclude or limit use of recycled materials, equipment needs of the industry--its cost and design, the nature of consumer solid wastes--material values are highly diluted, and depletion allowances encourage production and sale of primary materials over recycled.

Ten lower priority general problems were identified, and can be reviewed by referring to the section of this report on Recycling Industry Problems. The ten lower priority problems are:

- Periodic changes in types of scrap available
- Low labor availability
- Restricted management availability
- Rapid changes in nature of recycling industry
- Need for increased specialization in recycling industry
- High equipment cost and financing
- Strict pollution codes
- Classification of recycling industry as non-manufacturing
- Government stockpiling program
- Poor image of recycling industry by the public.

TABLE IV. IDENTIFICATION AND ANALYSIS OF HIGH-PRIORITY GENERAL PROBLEMS OF RECYCLING

	Irrational Customer Specifications and Discriminatory Government Procurment Policies	Nature of Consumer Solid Wastes	Lack of Know-how in Purchasing, Installing, Using, and Maintaining Equipment	Availability of Equipment	Depletion Allowances
Problem Definition	1. Some government specs call for primary materials only. 2. Some specs are designed to make it difficult for recycled materials to meet them. 3. Specs sometimes change depending on how easy it is to get materials. 4. Some specs are overdesigned in terms of product requirements. 5. These and other factors add up to considerable irrationality concerning specs for scrap and recycled materials.	1. Consumers generate large quantities of solid wastes of all types. 2. These are usually mixed together for disposal as municipal refuse. 3. Composition will vary considerably from day to day and month to month. 4. Percent composition of the mixed wastes varies greatly according to material--as high as 70 percent paper, often only 1 percent of some metals. 5. Thus, the nature of consumer solid wastes make recycling difficult	1. Due to industry cost structure, equipment utilization has not been a high priority item. 2. Industry, in general, is not process or production oriented. 3. Without knowledge or competent advice equipment purchases may tend to be irrational or defensive.	1. Equipment to perform some tasks not available or if available is not adequate. 2. Equipment in many cases too inflexible for general use.	1. Primary material industries receive an allowable deduction (15 percent of sales revenue in case of metals) from taxable income.
Effects of the Problem	1. Markets are reduced, and perhaps recycle rates slightly reduced, by irrational specs. 2. Smooth flow of materials is sometimes interrupted because materials are rejected by customer at one time that it would accept another time.	1. Most consumer solid wastes do not get recycled because disposed of in mixed refuse.	1. Operations not efficient. 2. Some maintenance costs higher than need be. 3. Some purchased equipment not suited to do the job that is required. 4. Productivity lower than could or should be.	1. Manual labor required but not available. 2. Unable to process some raw material economically.	1. Creates an unfair advantage in favor of primary materials. 2. Encourages mining companies and forest growers to sell increased volume of primary metal and virgin pulp. 3. Results in misallocation of resources.
Problem Analysis	1. Specs are sometimes unreasonable because primary people influence writing of specs. 2. Some users of materials write specs prejudicial to recycled materials to reduce risks. (Although some recycled materials are of low quality, most are not.) 3. It is difficult to get specs rationalized in face of large, well-organized primary companies, and antisecondary attitudes of some users of materials. Pressure from the social and environmental side may chage this. 4. Labeling laws (virgin-processed wool for example) tend to limit the market for recycled wool. 5. Very little affirmative action relative to recycled materials has been proposed. New York City is an exception to this as are some agencies of the Federal Government.	1. Nature of consumer solid waste is as it is for consumer convenience and to minimize collection costs. 2. Unlikely that consumer can be forced to segregate. 3. Unlikely that municipal refuse agencies are interested in multiple pickups of segregated wastes. 4. Government-subsidized R&D is underway on separation and recycling of consumer solid wastes. (For example, a Black-Clawson System in Franklin, Ohio).	1. There has been a lack of engineering type personnel in the industry. 2. Industry is reluctant to seek out consulting engineering assistance with problems involving purchase, installation, and operation of equipment. 3. Little interchange of ideas among industry members. 4. Individual firms may purchase much equipment they do not need or which is not economical. 5. Mutual distrust between scrap industry and the equipment manufacturers. 6. With better process and production know-how industry could economically recycle more scrap.	1. Some equipment is only applicable to large volume operations 2. Market for scrap processing and handling equipment may not be large enough to attract research money. 3. Scrap industry slow to adopt processing innovations. 4. Equipment or process innovation developed at the processor level is seldom shared with other processors. 5. If proper equipment was available at reasonable cost, more scrap could be recycled.	1. Depletion allowance was originally adopted to encourage exploration and development of natural resources. 2) Currently viewed by many as simply a discriminatory tax break for the natural resource industries. 3. Those companies producing both primary and secondary materials are encouraged to produce and sell primary to obtain depletion allowance. 4. This has a strong negative effect on recycling.

Table V recommends actions to ease the five high-priority general problems of recycling. Included are the actions that should be taken, who should take them, and the specific steps for getting started. Recommended actions for the ten lower priority problems can be found in the last section of this report on Courses of Action. In all cases, important roles are suggested for NASMI, EPA, other Federal, State, and municipal government agencies, and individual companies.

Although the subject of transportation has not been included in the lists of problem areas that inhibit recycling, its importance is recognized and is discussed in the body of this report volume. Transportation, and more specifically the matter of freight rates, is a very complex area and the Battelle research staff was not in a position to fully investigate nor evaluate reported instances of freight rate discrimination. There undoubtedly are a number of cases where discriminatory freight rates place processed wastes in an unfavorable competitive position in relation to primary materials in serving their common markets. Such discrimination, of course, would inhibit recycling and the problem should be critically reviewed by the appropriate regulatory bodies.

In conclusion, it is estimated that increases in recycle rates are possible for most of the commodities studied, but these increases are not likely to have a long-term, deleterious effect on the supply/demand balance. These increased supplies can be utilized and a new supply/demand equilibrium established, hopefully with minor price dislocations. Primarily, this is true because the increased recycling will be gradual over a period of years, thus allowing time for adjustment to changing conditions. There are additional factors that tend to reduce the impact of changing recycling rates. For some commodities, the U.S. is dependent on imports for large parts of the primary supplies - and often increasingly so. Thus, the effect on the domestic primary industries is minimal.

(27)

Waste paper may be the exception requiring that particular attention be devoted to developing new markets.

Generally speaking, the present recycling industry is capable of meeting the challenge of increased flows particularly since they will occur gradually and adjustments can be made accordingly.

TABLE V. RECOMMENDED ACTIONS, HIGH PRIORITY GENERAL PROBLEMS

	Irrational Customer Specifications and Discriminatory Government Procurement Policies	Nature of Consumer Solid Wastes	Lack of Know-How for Buying, Using and Maintaining Equipment	Availability of Equipment	Depletion Allowances for Primary Material
Recommended Actions	1. Insure that scrap and recycled materials always meet specifications. 2. Promote the high quality of scrap and recycled materials. 3. Encourage users to use realistic specifications. 4. Change government purchasing and procurement policies to encourage use of secondary materials. 5. Examine effect of labeling laws on recycling--modify laws if necessary.	R&D to recover valuable materials from mixed municipal refuse.	1. Education of the owners, users, and operators on the important aspects of equipment selection and utilization. 2. Encourage industry members to discuss through their trade association their equipment problems and solutions with other members of the industry. 3. More cooperation between manufacturers and users of equipment.	1. Encourage research and development of needed equipment. 2. Coordination between scrap processors and manufacturers to translate needs into specific equipment designs and developments.	1. Determine the effect of depletion allowances on recycling and the recycling industry. 2. Take action based on the results of a comprehensive study.
By Whom (1)(2)(3)	NASMI/NASMI Members/ Government Officials	EPA/NASMI	N - NASMI I - Individual scrap processors E - Equipment manufacturers	N - NASMI I - Individual scrap processors E - Equipment manufacturers	EPA/NASMI
Specific Steps	1. NASMI introduce a policing action to insure quality of products of NASMI members. 2. Expand promotion of recycled material on overall and specific commodity basis. 3. Tie promotion to environmental improvement movement. 4. Demonstrate to customers that reasonable specifications make economic sense to them.	1. NASMI undertake a comprehensive study of the municipal refuse situation, and recycling's place relative to it. 2. Based on the investigation, plan the role of the recycling industry in the total municipal refuse picture. 3. Set up a task force of members and nonmembers to analyze the economics of various alternative and combinations of handling, separation, recycling, disposal, etc., of municipal refuse and its components. 4. Take a leadership position in unifying and rationalizing the whole municipal refuse situation on a sound economic basis.	1. Initiate a program of equipment utilization seminars conducted by the manufacturers, consulting engineers, and experts from the scrap industry. (N) 2. Institute a formal procedure for compiling problem-solution case histories on process and equipment utilization. (N) 3. Recruit capable engineering personnel familiar with equipment and its operation on an industry wide basis. (N,I) 4. Organize and set up a consulting group available to members on a fee basis to assist with equipment and process planning and problems. (N) 5. Develop equipment that is more maintenance free or at least relatively simple to maintain. (E)	1. Underwrite equipment or process oriented research. (N) 2. Encourage processors to discuss innovations and processing limits. Become an industry. (N) 3. Convince equipment manufacturers that equipment is needed. (N,I) 4. Encourage industry utilization of new equipment and innovations. (N)	1. Commission a study to examine the effect of depletion allowances on recycling and then recommend modifying tax structure accordingly.

(1) The responsibility for recommended actions shown in this table are based on importance of the action, benefit to the taxpayers, and opportunities for NASMI. They are the best judgments of Battelle.

(2) Recommended actions were distributed between high priority and lower priority based on the evaluation with three criteria.

(3) It is suggested that NASMI continue its leading role in recycling, recognizing that other organizations such as the Bureau of Mines, Department of Commerce, Council of Environmental Quality, HEW Office of Information, and State, Local, and Federal Legislatures must be involved.

INTRODUCTION

In June 1970 Battelle-Columbus undertook a research program for the National Association of Secondary Material Industries, Inc. (NASMI). This was under a subcontract of the Office of Solid Waste Management grant to NASMI. This is the general or summary report on the recycling of solid waste materials. Eight other companion reports cover specific commodities that are recycled.

Background

The Office of Solid Waste Management is responsible for formulating and recommending Federal Government policies in the area of solid waste pollution control. This includes pursuing appropriate research to determine the status and problems of solid waste management activities, and to develop programs to reduce solid waste pollution.

One approach to the reduction of solid waste pollution is to reclaim waste materials for reuse - the recycling concept. A well established industry--the secondary materials industry--exists to accomplish this recycling. NASMI is the trade association representing the metals and the paper and textiles portions of this industry.

(30)

The scrap processors, secondary smelters, and other companies that make up the secondary materials industry have developed effective channels and methods for recycling nearly all waste materials of economic value. These companies have performed their difficult and essential functions well in the traditional economic environment.

More recently additional dimensions have been added to this traditional economic environment. These new dimensions are (1) improvement of the living environment, and (2) increased national concern with conservation of natural resources. These new dimensions provide new challenges and opportunities for the recycling industry. No longer is economic gain the sole driving force for recycling of waste materials. Social gain has been added in the forms of improved living conditions and preservation of resources for future generations. In an economics-based nation this creates problems of interpretation and evaluation of non-economics-based goals and activities.

The purpose of this series of reports is to identify obstacles to the recycling of nonferrous solid wastes, and to recommend directions for investigation and research to overcome these obstacles.

Objectives

The objective of the study on which this report is based was to identify opportunities for the increased utilization of solid waste. The major sub-objectives were:

(1) To determine the structure and functions of the secondary materials industry, and its relationships to sources of supply and markets

(2) To identify and evaluate problems of recycling - materials, sources, industry, and markets, and

(3) To determine opportunities for increased recycling.

Scope

The major subjects included in the scope of the study are the secondary materials industry, the materials it recycles, the sources of solid wastes, and the markets for recycled materials. Activities peripheral to these major subjects are considered where pertinent to recycling.

The materials incuded in the study are limited to

Aluminum
Copper and Copper Alloys
Lead
Zinc
Nickel and Nickel Alloys (Stainless Steel)
Precious Metals (Silver, Gold, and Platinum)
Paper
Textiles.

Research Method

The methods and procedures used in the study included four types of activities. They were (1) literature search, (2) extensive survey, (3) in-depth survey, and (4) analysis and synthesis.

Literature Search

The literature search included gathering and reviewing pertinent books, Government reports, industry reports, and trade journals covering solid waste handling and problems, waste recovery and market data, and recycling of valuable materials.

The output of this effort included data and descriptive material, and an organized bibliography dealing with each of the commodities covered in the scope of the study.

Extensive Survey

The extensive survey of the secondary materials industry consisted of a mail survey and personal interviews with management personnel of companies involved with the collection processing, and sale of secondary materials. About 600 responses were received.

The information developed through the extensive survey included dollar sales, tons of major materials handled, types of solid waste processed, sources of materials, investment, equipment and facilities, number of employees, the amount of space used, and the grades and quantities of secondary materials produced.

The data from the extensive survey provided statistical tabulations of the regional distribution of the secondary materials industries by type of commodity in terms of numbers of establishments, volume of business, and numbers of employees.

In-Depth Survey

The in-depth survey of selected members of the secondary materials industry, their suppliers, and the users of their products served to identify the major technical and economic problems facing those companies involved with secondary material utilization. About 200 interviews were completed. Battelle-Columbus and NASMI commodity specialists selected the companies to be interviewed in depth.

Interview guides for each of the commodities were prepared. The problems and potential solutions for greatest recycling and waste utilization that were developed from the literature search and prior Office of Solid Waste Management Studies plus the knowledge of the NASMI commodity specialists provided the basis for designing the interview guide. Sample guides are reproduced in the Appendix.

Analysis and Synthesis

The analysis and synthesis step was concerned with the collation and analysis of data and information derived from the literature, the extensive survey, and the in-depth survey. The analysis and synthesis activity covered the following tasks:

(1) Economic Data on the Secondary Materials Industries. The economic data developed through the extensive survey of the secondary materials industries were tabulated and analyzed to determine the amount and type of solid waste handled, and to obtain operational data such as number of employees, amount of space required, capitalization, and geographic locations.

(2) Flow Diagrams and Life Cycles. Flow diagrams were developed to show the flow of materials from primary production and scrap sources through fabrication. Life cycle estimates of various products were used to develop data on the amounts of materials for possible recycling.

(3) Demand-Supply Relationships. Estimates were made of future demand and supply levels for secondary materials. The relationships between these data provide an indication of potential surpluses or shortages of recycled materials through 1980.

(4) Stability of Flow and Consumption. This analysis is closely related to the supply-demand analysis described above and identifies the ability of the various secondary materials to compete as source materials for manufacturers. A number of factors were examined such as price changes in the secondary materials, the availability of materials, the effect of sudden changes in the magnitude of demand, and consumer acceptance of secondary materials.

(5) Direct Impacts of Technological Change. Direct technical and technological factors were examined to determine their effect on rates of processing and recycling. Potential changes that could take place in technology that could decrease or increase the rate of solid waste recovery were examined. This includes the identification of potentially recoverable solid wastes, the problems limiting the recovery to current levels, and the possibilities of technical advances through the use of known technology or through added scientific and engineering research.

(6) Constraints on Expansion of the Secondary Materials Industries. This analysis included consideration of elements critical to the expansion of recycling such as labor and management availability, laws and regulations, equipment availability, nature of solid waste materials, and market needs.

(7) Potentials for Expansion of the Secondary Materials Industries. Based on the constraints identified in the above task, plus examination of methods for overcoming constraints, this task determined the ability of the secondary materials industries to meet new opportunities for recycling.

(8) Indirect Technological Change. The broad overall technological trends indirectly affecting the secondary materials industries were examined, and their probable impacts determined.

THE RECYCLING CONCEPT

Traditionally nearly all recycling that was done, was done for economic gain. Scrap generators, the recycling industry, and the users of recycled material have shared the economic benefits.

More recently benefits other than economic are being given increased attention. Major among these are:

- Reduction of environmental deterioration
- Conservation of resources.

Public protest, publicity, legislation, and pressure concerning these noneconomic factors have influenced recycling. A few examples are: (1) restrictions on open burning of insulated wire, (2) the programs of aluminum producers to recycle aluminum cans, (3) auto company programs to recycle abandoned autos, and (4) a city government using recycled paper for part of its needs.

As a result of this increased interest and activity in recycling, the established recycling industry faces a great challenge and expanding opportunities for growth. Recycling is becoming an increasingly important alternative to incineration, landfilling, and dumping as a method for handling all types of solid wastes.

Much research is underway to determine what solid wastes may have recycling values, and to develop methods for recovery of these values. All types of organizations are conducting the research - universities, research organizations, manufacturers, Government agencies, and trade associations. All of this research activity to date has resulted in a great deal of publicity about the advantages of recycling, increasing interest in the concept, and the promise of better methods and equipment for accomplishing recycling.

This publicity has put the recycling industry in the spotlight - recycling is "in". This opens up the industry to praise and support for its accomplishments and criticism for its failures. More importantly it provides a forum for putting its message of recycling across to the people and to businessmen.

The increasing interest in recycling provides a base for changes in recycling. No longer is the recycling industry operating in a half-hidden, little-understood world of its own. Other companies not previously directly concerned with recycling to any degree are now interested in the industry and its opportunities, and are buying recycling oriented companies in order to get involved. Additional companies that have capabilities in products or processes that conceivably could be applied to recycling are investigating the opportunities in the industry.

The promise of improved processing methods and equipment is the most important and far reaching result of current interest in recycling. It will improve the economics of recycling marginal and submarginal solid wastes, and allow more materials to be recycled. In the longer term it will allow the economic recycling of large new categories of wastes--paper, metal cans, and other materials--largely from municipal refuse.

GOVERNMENTAL INFLUENCE ON SOLID WASTE UTILIZATION AND RECYCLING

Governmental influence on solid waste utilization and recycling is felt in at least three different ways. These are effects on the allocation of resources, effects on the operation of the secondary materials industries, and effects on the consumption of recycled materials. Influences may be manifest in more than one way or area. For example, export regulations affect both the allocation of resources and the operation of the secondary industry by regulating the movement of scrap on an international basis.

An analysis of various areas of governmental influence or legislation effecting solid waste utilization and recycling is presented in Table 1. The information contained in this table is general and indeed may be more or less important or applicable in certain regions, industries, or commodities than in others. A more specific treatment of this subject area is considered outside the scope of this study.

Governmental influence at the Federal level on solid waste utilization and recycling on the whole is moving from a slightly negative stance to being slightly positive or supportive of the recycling concept and the recycling industry. The Resource Recovery Act of 1970 and its predecessor The Solid Waste Disposal Act were significant steps forward in the promotion of the recycling concept.

Title II of the Resource Recovery Act of 1970 is of particular interest because it creates a National Commission on Materials Policy which is charged with--"developing a national materials policy which shall include, without being limited to:

TABLE 1. GOVERNMENTAL AND LEGISLATIVE INFLUENCES ON RECYCLE AND THE RECYCLING INDUSTRY

Influence	Level of Government			Effects			Analysis
	Federal	State	Local	National Allocations of Conservation of Resources	Operational Efficiency of the Recycling Industry	Market for Recycled or Secondary Materials	
Pollution Codes	X	X	X		X		1) Three levels of legislation cause conflicts and uncertainties with regard to pollution control equipment and continued operation. 2) Different codes in different localities cause industry dislocations. 3) Added financial burden may force some marginal firms out of business.
Export Restrictions	X			X	X	X	1) Export restrictions favored by consuming (smelter) segment of secondary materials industry and opposed by processor/dealer segment of the industry. 2) Degree of restriction effects production levels in primary and secondary sector.
Depletion Allowances	X			X		X	1) Depletion allowances offer advantage to primary producers over secondary producers. 2) Depletion allowances may work against recycling and encourage depletion of natural resources.
Stockpile Policy	X			X	X	X	1) Stockpile policies sometimes reinforce cyclical swings in supply-demand situation thus increasing problems.
Transportation Rates and Policy	X				X	X	1) Transportation (specifically rate structures) policy appears to favor primary material over scrap or secondary material. 2) High costs of transportation often prevent some types of obsolete scrap from being recycled; specifically low-price or high-volume scrap such as paper, textiles, and auto hulks.

TABLE 1. GOVERNMENTAL AND LEGISLATIVE INFLUENCES ON RECYCLE AND THE RECYCLING INDUSTRY (Continued)

Influence	Level of Government			Effects			Analysis
	Federal	State	Local	National Allocations of Conservation of Resources	Operational Efficiency of the Recycling Industry	Market for Recycled or Secondary Materials	
Discriminatory Purchasing Policies	X	X	X			X	1) Includes specifications, labeling requirements, and procurement policies favoring primary or virgin material or components. 2) Policies often result from lobbying activities of special interest groups; may be political in orientation.
Discriminatory Classification, Licensing and Restriction of Scrap Processors		X	X		X		1) In many cases classifications and licenses do not reflect the secondary materials industry in the proper context; i.e., a manufacturing industry and not a resale or wholesale industry. 2) Scrap processing industry is often legislated against (license requirements, restrictive zoning, fencing) on basis of industry name and not on individual merit or guilt.
Auto Titling Laws		X		X			1) Extremely difficult in some localities to legally collect and dispose (deliver to an auto wrecker or scrap processor) of abandoned automobiles. 2) Modification of many of these laws needed to aid scrap industry in collecting and recycling abandoned autos.
Zoning Laws			X		X		1) Zoning laws in many cases arbitrarily administered and applied to firms based only on company name or function and not on an individual basis. 2) Urban renewal and expressway construction often forces scrap processor or collector out of business permanently since may be difficult to find new area properly zoned or suitable as a base of operations.

(1) National and international materials requirements, priorities, and objectives, both current and future, including economic projections;

(2) The relationship of materials polity to (a) national and international population size and (b) the enhancement of environmental quality;

(3) Recommended means for the extraction, development, and use of materials which are susceptible to recycling, reuse, or self-destruction, in order to enhance environmental quality and conserve materials;

(4) Means of exploiting existing scientific knowledge in the supply, use, recovery, and disposal of materials and encouraging further research and education in this field;

(5) Means to enhance coordination and cooperation among Federal departments and agencies in materials usage so that such usage might best serve the national materials policy;

(6) The feasibility and desirability of establishing computer inventories of national and international materials requirements, supplies, and alternatives; and

(7) Which Federal agency or agencies shall be assigned continuing responsibility for the implementation of the national materials policy."*

The above excerpt indicates the potential far reaching coordinated effort that could be forthcoming under proper guidance and coordination. For example, one could envision a coordinated national materials policy taking into consideration depletion allowances, stockpile policies, transportation policies, export and import policies and other factors all of which could form the basis for proper allocation of resources and recycling rather than disposal of solid wastes.

State and local influence appears to be directed more at the local scrap processor or dealer than at recycling or the recycling industry as a whole.

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* "Resource Recovery Act of 1970", Public Law 91-512, 91st Congress, H.R. 11833, October 26, 1970.

These influences are usually restrictive in nature and in some cases discriminatory and/or arbitrary in focus. It is often the smaller processor, dealer, or collector who is hurt the most (since he can ill afford to move, fence, or change methods of operation) by these restrictions. For example, urban renewal or highway construction might make it necessary to dislocate a scrap processor and/or collector who was servicing that immediate area of the city. Zoning laws probably make it necessary for the firm to relocate outside of the city and thus may make collection of obsolete scrap from the affected area of the city more difficult if not completely uneconomical. Small operations often leave the industry and go out of business when faced with the problem of moving to a new location. These small operations serve a very valuable function by collecting and perhaps processing lower grades of obsolete scrap. It is this least economical and perhaps ecologically most important area of obsolete scrap recycling that may be hurt most by these types of dislocations essentially caused by progress.

It is important for all levels of government to consider the complete recycling network when proposing or amending legislation or policy affecting or designed to affect the network. Thus, while ecologists lobby for government agency usage of recycled paper, there should be consideration given to the effect government influence has on the recycling industry--the collectors, dealers, processors, and brokers of waste paper--and also on the allocation of resources relative to depletion allowances and the use of government owned timber land by the paper industry.

It is hoped that the National Commission on Materials Policy will be another step in the direction of a coordinated effort to increase the utilization of solid waste, and that it will supplement the activities of the Office of Solid Waste Management Programs.

THE RECYCLING INDUSTRY

The recycling industry includes those companies involved in the collection, transportation, processing, and utilization of scrap and wastes from manufacturing operations and users. Figures 1 (metals) and 2 (paper and textiles) depict this industry and its materials flow (shaded portions), and its relationship to primary processors of materials. The major difference between the metals and nonmetals recycling industries is the presence of the secondary smelters in the metals recycle. The scrap processor is roughly equivalent to the miners and concentrators of ores for primary metal production. The secondary smelter is the equivalent of the primary smelter. In some cases a smelter is both a primary and secondary smelter, using both concentrates and scrap in its furnace charges.

There are specialists in the paper and textile recycling area such as deinking plants and secondary mills. The paper and textile recycling flows are further complicated by multiple uses. For example, recycled textiles are used in paper and wiping rags as well as in textiles. Recycled papers are used in roofing felts as well as in paper and paperboard.

Both figures show the two major types of scrap that are the raw materials of the recycling industry - prompt industrial and obsolete. Prompt industrial scrap is the waste generated during a manufacturing operation. The obsolete scrap is generated when a used product is no longer useful and is discarded. This includes a great variety of types of scrap and situations. First, the value of the scrap varies widely - the lead in a discarded storage battery may be worth $3.00 as recycled lead, while the zinc in an auto door lock may be worth under one cent.

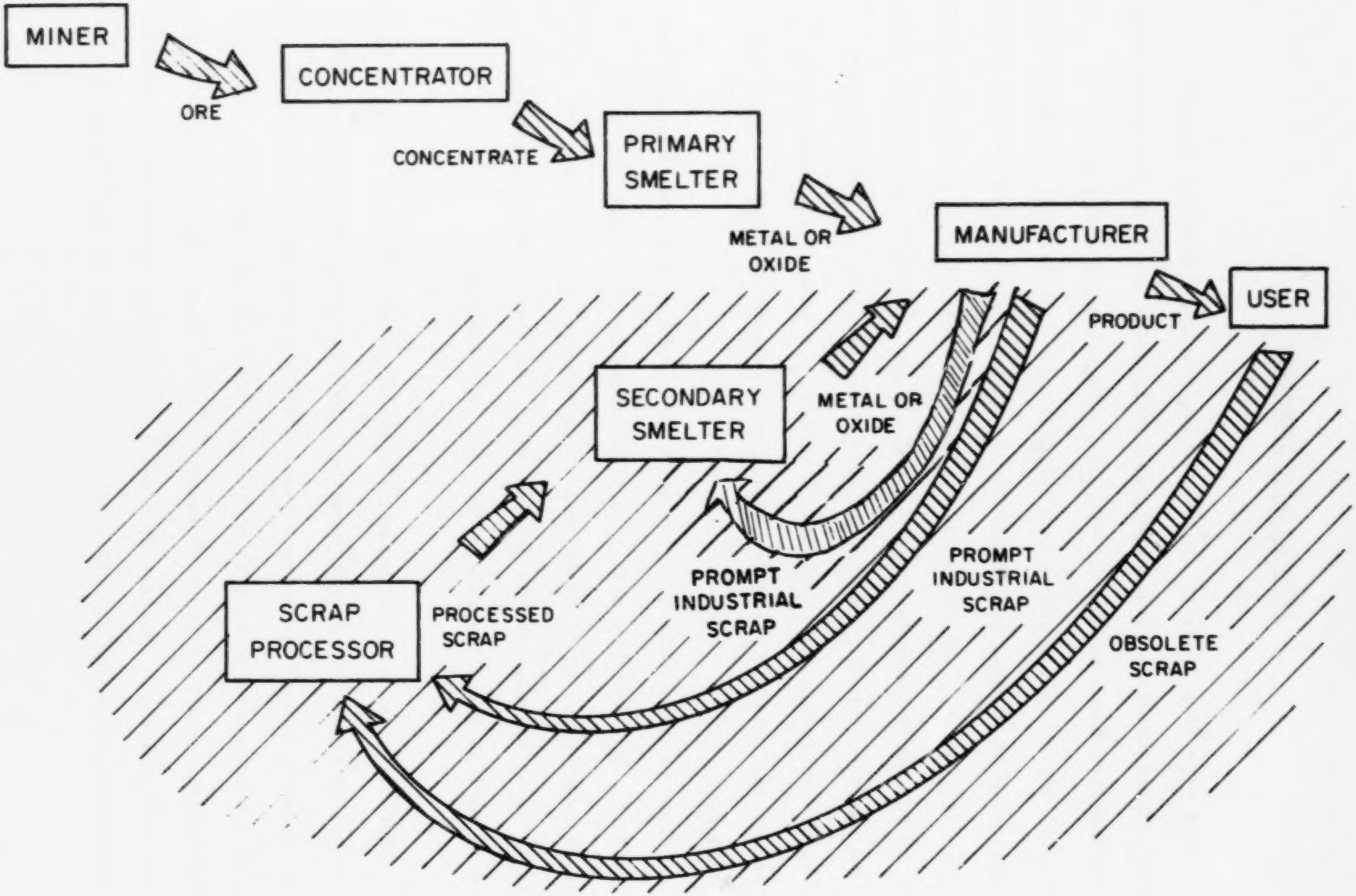

MINER
ORE
CONCENTRATOR
CONCENTRATE
PRIMARY SMELTER
METAL OR OXIDE
MANUFACTURER
PRODUCT
USER
SECONDARY SMELTER
METAL OR OXIDE
PROMPT INDUSTRIAL SCRAP
PROMPT INDUSTRIAL SCRAP
OBSOLETE SCRAP
SCRAP PROCESSOR
PROCESSED SCRAP

FIGURE I. FLOW OF PRIMARY AND RECYCLED METALS

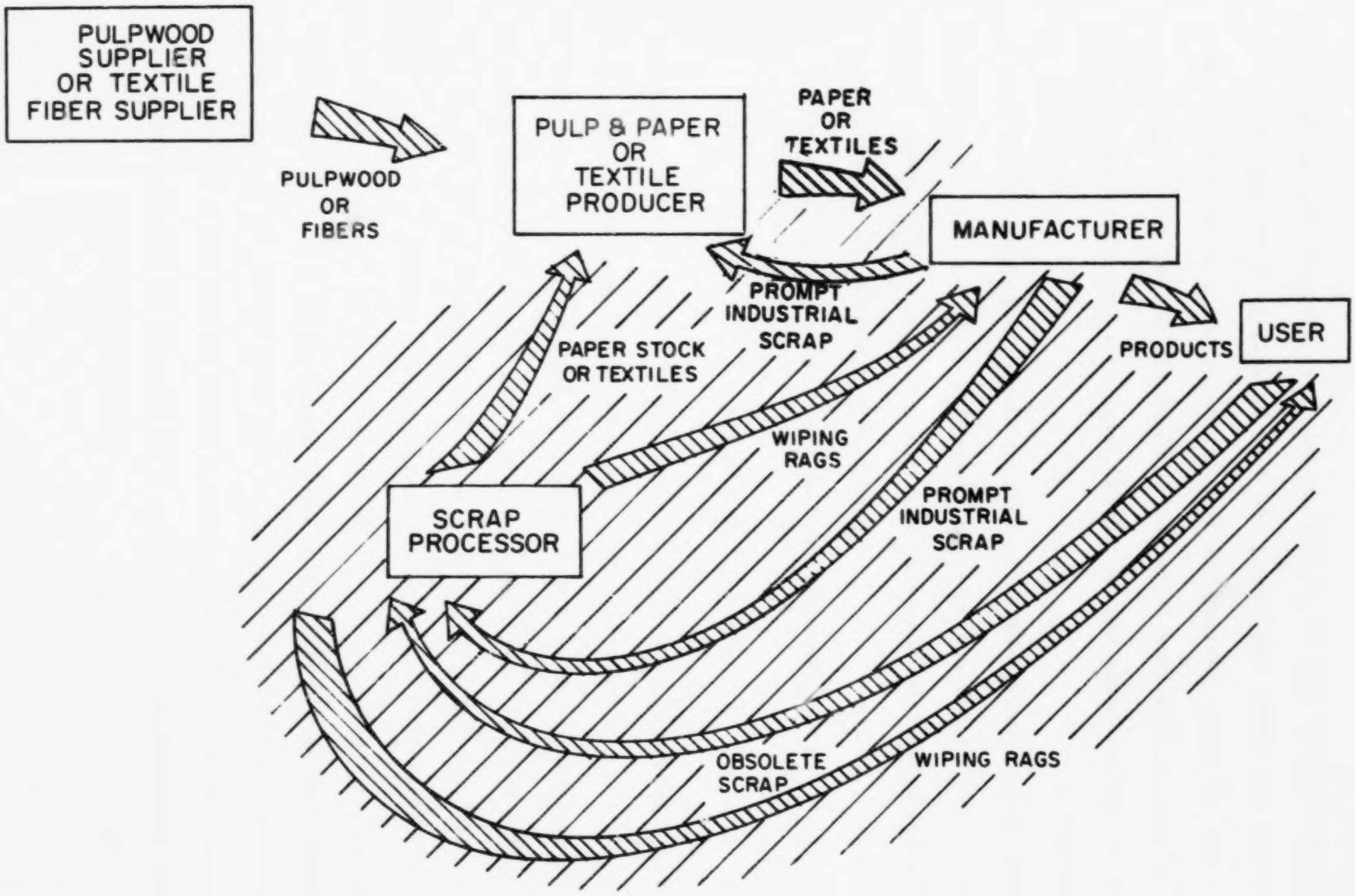

PULPWOOD SUPPLIER OR TEXTILE FIBER SUPPLIER
PULPWOOD OR FIBERS
PULP & PAPER OR TEXTILE PRODUCER
PAPER OR TEXTILES
MANUFACTURER
PRODUCTS
USER
PROMPT INDUSTRIAL SCRAP
PAPER STOCK OR TEXTILES
WIPING RAGS
PROMPT INDUSTRIAL SCRAP
SCRAP PROCESSOR
OBSOLETE SCRAP
WIPING RAGS

FIGURE 2. FLOW OF VIRGIN AND RECYCLED PAPER AND TEXTILES

Second, the time scale of recycling varies widely - an aluminum can may be scrapped within a few weeks, the copper and lead in utility cable may not be scrapped for over 50 years. Third, the form of the obsolete scrap varies - the old newspapers from a collection drive may be about 100 percent waste paper, while a batch of textile waste may be only 30 percent cotton fibers and the rest worthless synthetics.

These three examples of variations in obsolete scrap represent some of the bases for the problems faced by scrap processors in the collection, handling, sorting, and other activities concerned with obsolete scrap. The smooth, logical flow of recycling in Figures 1 and 2 is possible only because of the ingenuity and hard work of the dedicated people that make up the recycling industry.

Recycled Materials

Table 2 provides an analysis of the major types of recyclable materials. The wide range of types of materials that can be recycled is apparent in this table. The variations in sources of the materials and the rates at which they are currently being recycled are equally wide. The scrap generated by manufacturers, i.e., prompt industrial scrap, is recycled at a rate approaching 100 percent. The daily wastes of households are recycled at a rate near 0 percent.

The table reveals that the opportunities for major increases in recycling are in the areas that have traditionally been classified as wastes. Major among these are municipal solid wastes, chemical wastes, flue dusts, and manufacturing composite wastes. A concerted attack on these wastes by the recycling industry may create new opportunities for the industry in addition to reducing solid waste disposal problems.

TABLE 2. ANALYSIS OF TYPES OF RECYCLABLE MATERIALS

Type of Material	Examples	Condition of Scrap	Sources	Recycle Rate, percent
Manufacturing residues	Drosses Slags Skimmings	Highly variable in composition depending on the major constituents. Usually 10% to 75% recoverable material.	Metal melting operations - smelters, casters.	Over 75
Manufacturing trimmings	Machining wastes Blanking and stamping trimmings Casting wastes	Highly variable as to size and shape. Usually over 90% recoverable material.	Shaping operations - casters, stampers, machiners, fabric cutters, paper cutters.	Nearly 100
Manufacturing overruns	Obsolete new parts Extra parts	Usually small size. Variable compositions.	Large manufacturers of mass-produced products.	Nearly 100
Manufacturing composite wastes	Galvanized trimmings Blended textile trimmings Coated paper wastes	Highly variable as to composition, size and shape. Often costly to process. Often, not all constituents are recovered.	No significant pattern of sources.	0 to 100
Flue dusts	Brass mill dust Steel furnace dust	Highly variable in composition and bulk density. Often not economical to recover.	Metal smelter and caster	Under 25
Chemical wastes	Spent plating solutions Processing plant sludges, residues, and sewage	Highly variable in composition. High value materials often recoverable.	Platers, metal cleaners, process industry plants.	Under 10
Old "pure" scrap	Cotton rags Copper tubing	Highly variable as to size and shape. Usually over 90% recoverable material.	Consumers, industrial users, utilities, and other users of the products that are scrapped.	Over 75
Old composite scrap	Irony die castings Auto radiators Paper-base laminates	Highly variable as to composition, size, shape, and difficulty of separation. Often not economical to recover valuable materials.	Consumers, industrial users, utilities, and other users of the products that are scrapped.	0 to 100
Old mixed scrap	Auto hulks Appliances Storage batteries	Highly variable as to composition, size, shape, and difficulty of separation. Not all materials are recovered.	Consumers, industrial users, utilities, and other users of the products that are scrapped.	Under 50
Solid wastes	Municipal refuse Industrial trash Demolition debris	Completely variable. Nearly always low in valuable materials. Very low recovery rates now.	All individuals and organizations.	Under 1

Source: Battelle-Columbus estimates of recycle rates.

Characteristics of the Industry

The characteristics of the recycling industry are considered here from two viewpoints:

Companies

Operations.

Companies

NASMI classifies recycling companies into 16 groups. Table 3 lists these with descriptions of the operations of each. Many companies operate in more than one category. Others will specialize as to materials handled or functions performed. There is no neat classification system that allows easy identification and understanding of a given company. Thus, the table is no more than a guide to some of the ways recycling companies may specialize.

Operations

The recycling industry is essential to the economic well-being of the nation. It takes waste materials and manufactures from them materials that are again useful to manufacturers of products of all types.

Table 4 provides an analysis of the operations of scrap processors. The types of functions performed are similar to other businesses, but perhaps more difficult than many. This is based on the need for a scrap processor to be both a manufacturer and a commercial establishment. Because the raw material that can be purchased varies widely in type and composition, the manufacturing operations can be extremely difficult. The trading function can be even more difficult. It is necessary to find and purchase satisfactory scrap at a price that will allow a profit when sold. Often the selling price will change while the scrap is being processed, thus the processor continuously must keep abreast of market conditions.

TABLE 3. CLASSES OF RECYCLING COMPANIES

Class of Company	Description of Operations	Class of Company	Description of Operations
Nonferrous Scrap Metal Processor	(1) Locates scrap (2) Purchases (3) Identifies (4) Sorts and separates (5) Sizes the scrap (6) Densifies (7) Markets (8) Delivers	Importer and Exporter	(1) Locates domestic or foreign scrap sources (2) Locates domestic or foreign scrap customers (3) Buys (4) Markets (5) Arranges transportation
Nonferrous Metal Broker	(1) Locates scrap sellers (2) Locates scrap customers (3) Buys (4) Markets (5) Arranges pickup and delivery (6) Stabilizes source of supply	Laboratory and Assayer	(1) Analyzes materials for a fee (2) Certifies composition
Smelter and Refiner	(1) Buys scrap (2) Upgrades by adjusting composition and casting into ingots or pigs (3) Markets to specifications	Manufacturer of Equipment	(1) Designs and manufactures equipment (2) Includes equipment for recycling industry
Sweater	(1) Buys scrap (2) Upgrades by melting one metal and separating from other metals with higher melting points that remain solid (3) Casts into ingots or pigs (4) Markets	Paper Stock Dealer	(1) Collects waste paper from generators or collectors (2) Sorts waste paper and bales as paperstock (3) Sells paperstock to users
Ingot Maker	(1) Buys scrap (2) Melts selected scraps to composition and casts into ingots (3) Markets to specifications	Rubber and Plastic Scrap Dealer	(1) Buys and sells rubber and plastic scrap
Brass Mill	(1) Buys scrap (2) Melts selected scraps and other materials to composition and casts into ingots (3) Produces sheet, strip, and other shapes from ingots (4) Markets shapes to size and specification	Textile Dealer	(1) Buys and sells scrap (2) Sorts into categories (3) Acts as broker (4) Processes (cuts, washes, etc.)
Primary Metal Producer	(1) May mine ores or purchase (2) May concentrate ores or purchase (3) Upgrades concentrates by reduction to metal, adjusting composition, and casting into ingots or pigs (4) Markets to specifications (5) Sometimes also operates as secondary smelter and refiner	Textile Garnetter	(1) Buys (2) Sorts (3) Shreds and combs (4) Markets
Scrap Iron Processor and Broker	(1) Locates Scrap (2) Purchases (3) Identifies grades (4) Separates and sorts (5) Sizes the scrap (6) Densifies (7) Markets (8) Delivers (9) Often also operates as nonferrous processor or paper stock dealer	Wood Pulp Dealer	(1) Buys and sells or brokers market pulp produced by pulp mills.

TABLE 4. ANALYSIS OF SCRAP AND PROCESSOR OPERATIONS

Function	Methods
Collection of Scrap	(1) Arrangements with industrial scrap generators to buy and pick up scrap. Sometimes provides special containers and equipment at generators' plants. (2) Spot buying of scrap from factories, brokers, collectors, and other sources and picking up or arranging for delivery of the scrap. (3) Arrangements with organizations for scrap drives. (4) Buying and taking delivery of scrap brought to the processing yard by individuals, truckers, or others.
Identification and Separation of Scrap	(1) Identification and hand separation of various scrap materials from each other and from waste materials. (2) Testing of materials by chemical, spectrographic, and other analytical methods. (3) Burning-off or mechanical removal of organic materials from noncombustible scrap materials. (4) Magnetic separation of ferrous from nonferrous scrap. (5) Separation of heavy materials from light materials by air classification. (6) Separation of low melting from high melting metal scrap by selective melting. (7) Heavy media flotation of heavy from light materials. (8) Chemical solution of one material to separate from another.
Upgrading and Packaging of Scrap	(1) Reducing the size of scrap by torching, shearing, shredding, sawing, or other methods. (2) Packaging the scrap by baling, bundling, briquetting, or other methods to make handling and transportation easier and to meet customer needs. (3) Densifying scrap for ease of handling, storage, and shipment.
Delivery of Scrap	(1) Delivery to customer by owned or leased trucks or barges. (2) Delivery by public truck, rail, barge, or other forms of transportation. (3) Delivery by customer-owned or leased conveyance.
Trading	(1) Finding sources of scrap and customers for scrap. (2) Buying and selling scrap at a profit. (3) Keeping current on scrap prices. (4) Keeping up with market interrelationships, Government regulations, etc.

Table 5 gives an analysis of the operations of smelcers. The types of operations of smelters are different than for scrap processors, but the problems are basically the same. Manufacturing and marketing are relatively more important than for the scrap processor, and buying of scrap is somewhat less important.

The Role of Capital Equipment in Recycling

Processing equipment presents the scrap processing industry with a "tool" to assist it in widening the opportunities for increased utilization of solid waste. Specifically, equipment offers assistance by:

(a) Increasing Productivity. Replacement of manual labor by equipment increases the productivity of the scrap processing operation. Thus, it may be possible to increase the production rate which in time and in a macro sense should increase the relative amount of solid waste that is recycled.

(b) Increasing Yields. The use of capital equipment in many cases will increase the marketable yield that may be obtained from raw material. In addition, equipment usage can make it economically feasible to process certain raw materials that, in the past, were not economical to process. For example, sophisticated separation processes may make it feasible and profitable to process some of the "complex scrap" (such as nonferrous fractions from auto shredders) not now being processed.

(c) Enhancing the Competitive Position of the Secondary Materials Industry Relative to the Primary Industry. Equipment offers the secondary materials industry an economical method to produce a competitive (specifications and price) product. This results in expanded markets for secondary materials and an opportunity to increase the utilization of solid waste.

TABLE 5. ANALYSIS OF SMELTER OPERATIONS

Function	Methods
Sizing of Scrap	(1) Baling of light scrap (such as wire, clippings, etc.) is sometimes done by smelters to make satisfactory furnace charging material. (2) Shearing of large pieces of scrap is sometimes done to reduce the sizes of scrap for charging to furnaces.
Upgrading of Scrap	(1) Sweating is done to remove low melting metals from higher melting inserts or attachments. (2) Fragmentizing and incineration are used to remove organic materials (such as wire insulation) from metals.
Refining	(1) Heat refining in smelting furnaces is the most widely used method of refining. (2) Electrochemical refining is used for some copper and precious metals. (3) Oxidation is sometimes done to produce metal oxides (such as zinc oxide) rather than the pure metal.
Melting	(1) Some metal scrap is not refined but merely melted and cast into pigs. The composition of the scrap must be carefully controlled since the output metal will have this same composition.
Alloying	(1) Alloying is often done in conjunction with refining. The output is then an alloy of the metal rather than the pure metal. Alloying is common for all the nonferrous metals. (2) Alloying can also be done in a simple melting operation. However, there is less choice of compositions than when alloying is done in conjunction with refining.
Analysis of Composition	(1) Analyses of scrap and recycled metals are made to determine composition for several reasons: • As a basis for pricing • To meet customer specifications • To make sure purchased scrap meets specifications • As a guide to refining procedures (2) Methods of analysis include (a) visual examination, (b) spark tests, (c) chemical tests, (d) chemical analysis, (e) spectrographic analysis. (3) Analysis is done on incoming scrap, on in-process metals, and on finished metals.
Trading	(1) Finding sources of scrap and customers for recycled metals. (2) Buying of scrap and selling of recycled metals at a profit. (3) Keeping current on scrap prices and metal prices.

The majority of companies in the recycling industry have long recognized the need for capital equipment and there has been an increasing need for the industry to move from a labor-intensive to a capital-equipment-intensive industry.

An indication of the present level of investment in equipment by the industry was obtained from the extensive survey. Table 6 shows the average investment of the respondents classified by business specialty. The average investment for the nonferrous scrap metal dealer-processor group is $844,000. The paper and textile equivalent group has an average investment in equipment of $783,000 and $695,000 respectively.

Types of Capital Equipment

Almost all scrap processing operations fall into one of the following categories:

- Collection
- Separation
- Upgrading
- Packaging
- Shipping.

In addition to the above, capital equipment is also used in conjunction with disposal of waste material and the general function of material handling. Table 7 expands this functional list into specific types of equipment along with typical uses for that equipment and a brief discussion of some of the problems and benefits associated with the type of equipment.

Much of the capital equipment is used to satisfy product or market requirements. For example, shears are used primarily to produce a product of acceptable size, shredders are used to liberate the desired scrap material from the raw material such as auto bodies or insulated wire, and balers are used to produce a product that is easy to handle, ship, and use. Capital equipment is

TABLE 6. SECONDARY MATERIALS INDUSTRY - AVERAGE INVESTMENT IN PLANT AND EQUIPMENT TABULATED BY TYPE OF BUSINESS SPECIALTY

Type of Business Specialty(1)	Average Investment ($1000)	Average Investment Per Employee ($1000)
Nonferrous scrap metal dealer-processor	844	19.2
Nonferrous metal broker	745	46.6
Smelter and refiner	3,122	33.2
Ingot maker	2,915	26.0
Brass mill	3,365	53.4
Scrap iron processor and broker	1,836	20.9
Sweater	na	na
Imported and exporter	1,312	54.7
Paper stock dealer-processor	783	18.2
Paper stock broker	1,002	20.9
Textile dealer-processor	695	7.2
Textile broker	na	na
Textile garnetter	1,675	6.4

(1) Type of business representing largest percent of firm's revenue.

Source: Battelle-Columbus extensive survey.

TABLE 7. IDENTIFICATION AND ANALYSIS OF SCRAP PROCESSING EQUIPMENT

Equipment	Function(s) Collection	Separation	Upgrading	Packaging	Materials Handling	Disposal	Shipping	Typical Uses	Analysis
Mobile Auto Crusher	X			X				(1) Reduce shipping volume for auto hulks. (2) Produce improved shredder feed. (3) May make auto hulk processing economical for remote areas.	(1) Appear to be gaining popularity. May be partial answer to abandoned auto problem.
Baler, Press, Briquetter			X	X				(1) Increase density of scrap for shipment. (2) Produce scrap that is easier to handle, store, and ship. (3) Produce a "sized" product.	(1) Contamination has been and continues to be a problem. Lower quality product. (2) Seems to be losing popularity to shredded scrap in many markets.
Refuse Compactors, Containers	X				X	X	X	(1) Supplier depository for raw material. (2) Material handling. (3) Part of disposal scheme for solid waste generated during processing. (4) Storage and shipment of high value scrap.	(1) Higher densities are desirable from a collection cost standpoint. (2) Reduces pilferage. (3) Prevents contamination. (4) Encourages generator segregation.
Shredder, Impact Grinder, Mill Hammermill, Crusher, Hogger, Battery Breaker, Fragmentizer		X	X	X				(1) Liberates desired raw material from other components. (Insulated wire and auto bodies for example). (2) Reduce size prior to baling. (3) Produce cleaner scrap. (4) Upgrade (turnings, etc.)	(1) This type of equipment is inherently self destructive and requires extensive maintenance both emergency and preventive. (2) This type of equipment is the heart of any scrap handling system. Much care must be taken in selecting proper model, size, etc. (3) Raw material supply is critical along with assured markets for scrap. (4) Need for lower energy mills that do not require extreme maintenance. (5) May require continuous operation to be profitable.
Shears, Torches, Saws		X	X	X				(1) Reduce size of scrap to marketable size. (2) De-package.	(1) Popular because of versatility
Scale	X					X	X	(1) Record weight of incoming and outgoing material	(1) No scrapyard can operate without scales. (2) Basis for all financial transactions on the buying end.

TABLE 7. IDENTIFICATION AND ANALYSIS OF SCRAP PROCESSING EQUIPMENT (Continued)

Equipment	Function(s)							Typical Uses	Analysis
	Collection	Separation	Upgrading	Packaging	Materials Handling	Disposal	Shipping		
Conveyors, Fork Lift Trucks, Other Mobile Materials Handling Equipment					X		X	(1) Physically move raw material and scrap from one point to another. (2) Automated loading for shipment. (3) Combination of conveying and vibratory separation.	(1) Need for developments in the design of automated materials handling equipment for the scrap processing industry. (2) Has been a neglected area from technology standpoint.
Separators--Magnetic, Heavy Media, Air, Screens, Chemical		X	X					(1) Remove impurities prior to shipment. (2) Separation prior to processing to increase capacity of unit or to divert for separate processing.	(1) Most separation processes are still hand operations. (2) Offers opportunity to obtain more revenue (yield) per ton processed. (3) Special purpose separators are available but are difficult to convert to general purpose.
Furnaces--Sweat, Incinerator, Dryers		X	X	X		X		(1) Liberation of raw material from combustible components (auto body, insulated wire). (2) Separate metals by melting point. (3) Produce pigs, etc., for easier shipping, storage, analysis, etc.	(1) Sweat furnaces may be a feasible method for separating white metals from nonmagnetic auto shredder output. (2) Incineration may again become an economical method of separation as improved pollution control equipment becomes available. (3) Often violate pollution codes.
Cranes--Magnetic, Grapple					X			(1) Physically move material during processing, loading, and unloading.	(1) Magnet capacity has reached the upper limit. Any increases will now come from new technology. (2) Is an inefficient method of material handling.
Pollution Control Equipment						X		(1) Allow the use of pollution generating processing equipment.	(1) While solutions are available for most operations, they tend to be very expensive. (2) Selection of equipment often requires trial and error.

TABLE 7. IDENTIFICATION AND ANALYSIS OF SCRAP PROCESSING EQUIPMENT (Continued)

Equipment	Function(s) Collection	Separation	Upgrading	Packaging	Materials Handling	Disposal	Shipping	Typical Uses	Analysis
Over-the-Road Trucks	X						X	(1) Collection and shipping of material.	(1) Becoming a necessary function in many areas in order to obtain a supply of raw material. (2) A sector of the secondary materials industry is becoming service oriented.
Secondary Smelting, Melting and Other Refining Furnaces		X	X	X				(1) Removing impurities. (2) Changing physical form. (3) Producing various alloys. (4) Analyzing composition.	(1) Pollution control is necessary with most of this equipment.
Identification Equipment--file, chemicals, spectrographs, etc.	X	X				X		(1) Grade raw material and prepared scrap. (2) Establish prices. (3) Controlling specifications.	(1) Automatic identification and sorting equipment not currently available. (2) Much of this type of equipment requires a skilled operator. (3) Most identification processes are manual.
Scrap Handling Systems		X	X	X	X	X		(1) Handle entire processing operation from receipt of raw material through loading for shipment.	(1) Necessarily inflexible--requires specialization. (2) Expensive but perhaps very profitable for a high tonnage operation. (3) Assured sources of supply and markets for product are necessary.
Systems to handle municipal wastes	X	X	X	X	X	X		(1) Handle municipal solid waste as an alternative to disposal. (2) Extract marketable materials from solid waste and sell. (3) Dispose of remaining material through normal channels.	(1) Not yet economical. (2) Not yet being considered as a viable alternative to disposal. (3) Government sponsored demonstration projects currently in process and to be funded in near future should assist development of feasible systems.

also used to satisfy governmental or other imposed regulation. For example, air pollution control equipment is used to comply with local or national pollution codes, while fences and buildings are also required for the same reason.

Markets for Recycled Materials

Market data, use patterns, and recycle rate data are presented in the following three subsections. More complete information can be found in the individual commodity reports of this series.

Commodity Markets

Consumption of the various recycled commodities (quantities and values) are given for 1969 in Table 8. Included in the table are the percentages that recycled materials were of total consumption (primary + recycled).

The differences in quantities of the various commodities that are recycled are striking. The 11,400,000 tons of recycled paper is about 3,500 times as much as the 3,300 tons of precious metals. Thus, from a solid waste pollution viewpoint, the recycling of paper is much more important than precious metals.

Two additional materials--aluminum and textiles--are high volume and are major solid waste pollutants. All materials other than paper, aluminum, and textiles are relatively minor pollutants.

Use Patterns

Table 9 shows the major markets for each recycled commodity, together with the percentage of the commodity consumed for each market. There is major market concentration for all the commodities except textiles. The largest market for recycled textiles accounts for only 16 percent of total sales. For the other commodities, the largest market in each case accounts for 40 percent or more.

TABLE 8. CONSUMPTION OF SELECTED RECYCLED MATERIALS, 1969(1)

Material	Consumption of Recycled Material (short tons)	$ Value	Recycled Material as Percent of Total Consumption in 1969
Aluminum	1,056,000	553,000,000	23
Copper and copper base alloys	1,489,000	1,460,000,000	46
Lead	585,000	175,000,000	38
Zinc	182,000	53,000,000	12
Nickel and nickel base alloys	42,100	209,000,000	29
Precious Metals(2)	79,000,000 troy ounces	487,000,000	40
Paper	11,400,000	250,000,000	19
Textiles	1,400,000	84,000,000	27
TOTAL		3,271,000,000	

Notes: (1) See individual commodity reports for substantiation
(2) Includes: Gold 1,800,000 troy ounces @ $35/oz
Silver 75,000,000 @ $1.70/oz
Platinum 2,200,000 @ $135/oz

TABLE 9. MAJOR MARKETS FOR RECYCLED MATERIALS, 1969

Material	Major Markets	Percent of Total Consumption by Each Market
Aluminum	Casting alloys	71
	Wrought aluminum products	24
		95
Copper	Brass mill products	47
	Brass and bronze foundry products	25
	Wire and wire products	20
		92
Lead	Storage battery lead	68
	Tetraethyl lead	13
	Solder	5
		86
Zinc	Galvanizing slab	40
	Oxides and chemicals	225
	Dust	19
		84
Nickel	Stainless steel	52
	Nonferrous alloys	14
		66
Stainless Steel	Stainless steel rolled products	74
	Exports	14
		88
Precious Metals	Jewelry Photo chemicals Catalysts Electrical and electronic	Not Applicable
Paper	Paperboard	71
	Construction, paper and board (including gypsum wallboard)	17
		88
Textiles	Wipers	16
	Paper	14
	Exports	13
	Padding and batting	11
	Roofing	7
	Flock and folder	7
		68

Recycle Rates

Table 10 gives data on the quantities available for recycling, and the quantities actually recycled for each material. The percent recycled varies from a low of 14 percent for zinc to a high of 88 percent for stainless steel.

In general, those materials with higher unit prices have higher recycle rates. However, there are other important influences on the recycle rates. The trade-in policy for auto batteries boosts the recycle rate for lead. The sacrificial corrosion of zinc from galvanized steel depresses its recycle rate. The decreasing demand for some grades of new paper and paperboard depresses the recycle rate for paper.

TABLE 10. RECYCLING RATES FOR SELECTED MATERIALS, 1969

Material	Short Tons(1) Available for Recycling, 1969	Short Tons Recycled, 1969	Percent Recycled, 1969	Short Tons Not Recycled, 1969
Aluminum	2,215,000	1,056,000	48	1,159,000
Copper	2,456,000	1,489,000	61	967,000
Lead	1,406,000	585,000	42	821,000
Zinc	1,271,000	182,000	14	1,089,000
Nickel	106,000	42,200	40	63,900
Stainless Steel	429,000	378,000	88	51,000
Precious Metals(2)	105,000,000 troy ounces	79,000,000 troy ounces	75	26,000,000
Paper	48,200,000	11,400,000	24	36,800,000
Textiles	3,200,000	1,400,000	44	18,000,000

Note: (1) Battelle-Columbus estimates. See specific commodity reports Volumes 2-9 for methodology.

(2) Includes:

	Troy Ounces		
	Available	Recycled	Not Recycled
Gold	2,200,000	1,800,000	400,000
Silver	100,000,000	75,000,000	25,000,000
Platinum	2,300,000	2,200,000	100,000

Industry Data

Highlights of the data developed by a computer analysis of the results of a census (the extensive survey) of a large sample of the recycling industry are presented below. Additional data are included in the Appendix.

National Analysis

Table 11 reveals some interesting aspects of the recycling industry. These data describe the average (mean) company. It is a surprisingly large company with 71 employees and annual sales of $7.5 million - a far cry from the traditional small scrap yard that so many people think of as typical. The $1.5 million investment in plant and equipment further indicates that this average company is a large operation.

TABLE 11. SELECTED DATA, RECYCLING INDUSTRY COMPANIES

Average annual sales	$7,540,000
Average number of employees	71
Average value of plant and equipment	1,480,000
Average investment per employee	20,800
Average annual sales per employee	106,000
Average investment per dollar of sales	5 cents

Source: Extensive Survey.

Figure 3 gives additional indication of the size of recycling companies. About one-third of the companies have more than 50 employees, and almost one-tenth over 150.

(62)

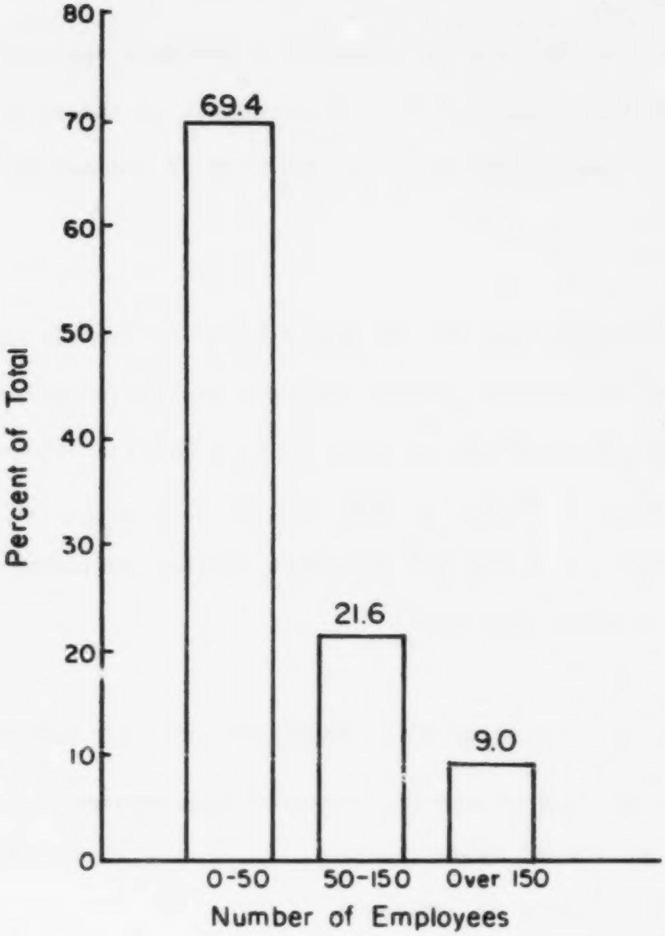


FIGURE 3. PERCENTAGE DISTRIBUTION OF RECYCLING INDUSTRY COMPANIES BY SIZE CLASS IN TERMS OF NUMBER OF EMPLOYEES
Source: Extensive Survey

Figure 4 indicates the variation in average size (number of employees) of recycling companies according to the major commodity they handle. The variation is quite great. Copper, lead, and textile specialists have almost 100 employees as averages, while zinc, stainless steel, exotic metals, and paper specialists have less than half that number.

Figure 5 uses another indicator of size of average company according to major commodity handled - investment in plant and equipment. Here, precious metals are extremely high, while zinc, paper, and textiles are low. The other commodities are grouped around the average. Figure 6 combines the data of Figures 4 and 5 to show average investment per employee according to major commodity handled. This emphasizes the variations of employment and investment.

Regional Analysis

The recycling industry shows major variations from census region to census region. This is as expected since demographic, economic, and industrial factors of the country also show major variations.

Figure 7 shows where the recycling companies are located geographically. The bars indicate the percent of total number of U.S. establishments in each region. The high-population-density, heavily-industrialized Middle Atlantic and East North Central states account for over one-half of the total number of recycling companies.

Figure 8, which shows percent of recycled materials sales by region, emphasizes the importance of the Middle Atlantic and East North Central regions even more than the number of establishments. Between them, the two regions account for about two-thirds of total U.S. sales of recycled materials.

(64)

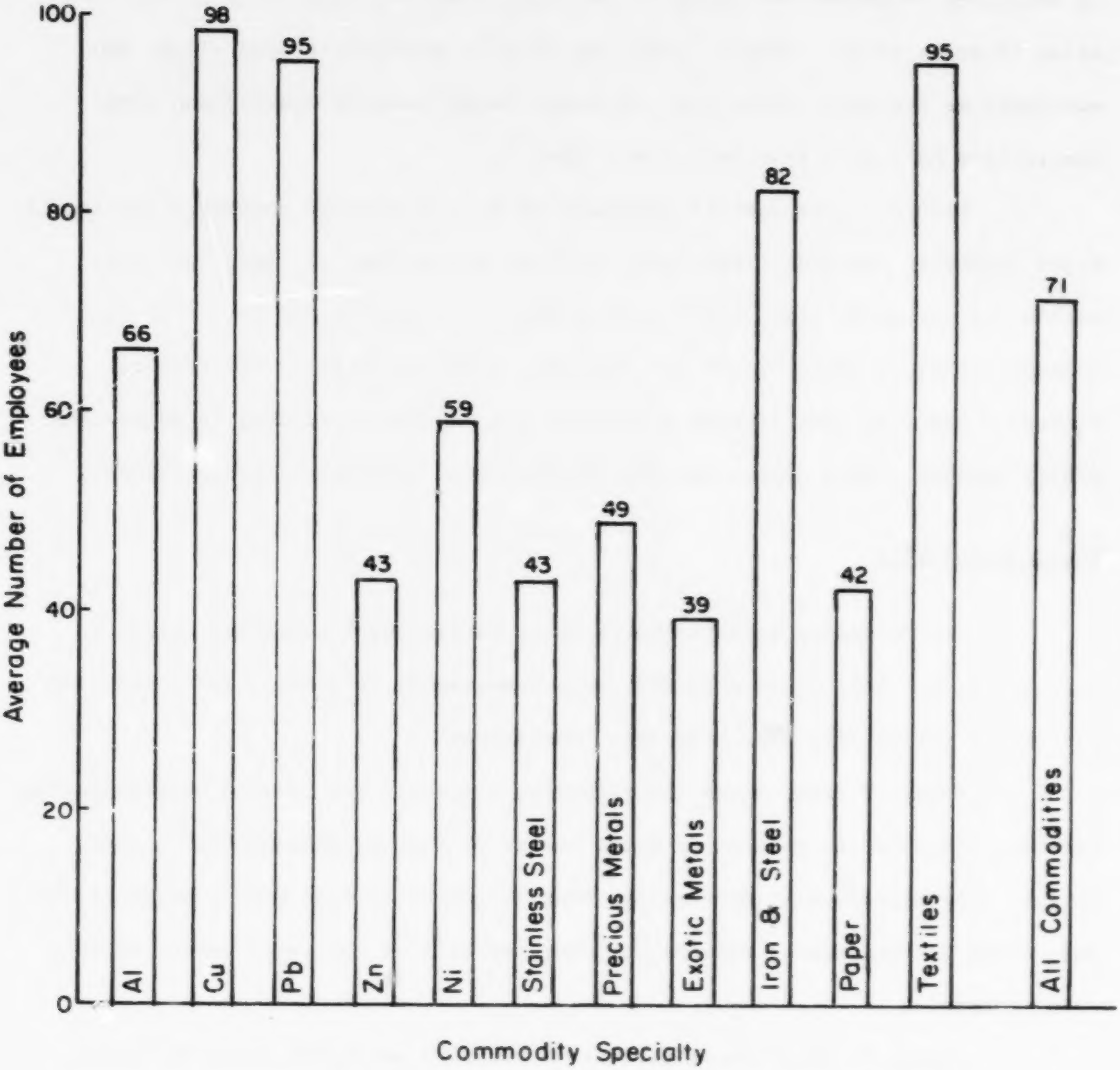


FIGURE 4. AVERAGE NUMBER OF EMPLOYEES OF RECYCLING COMPANIES, BY COMMODITY
Source: Extensive Survey

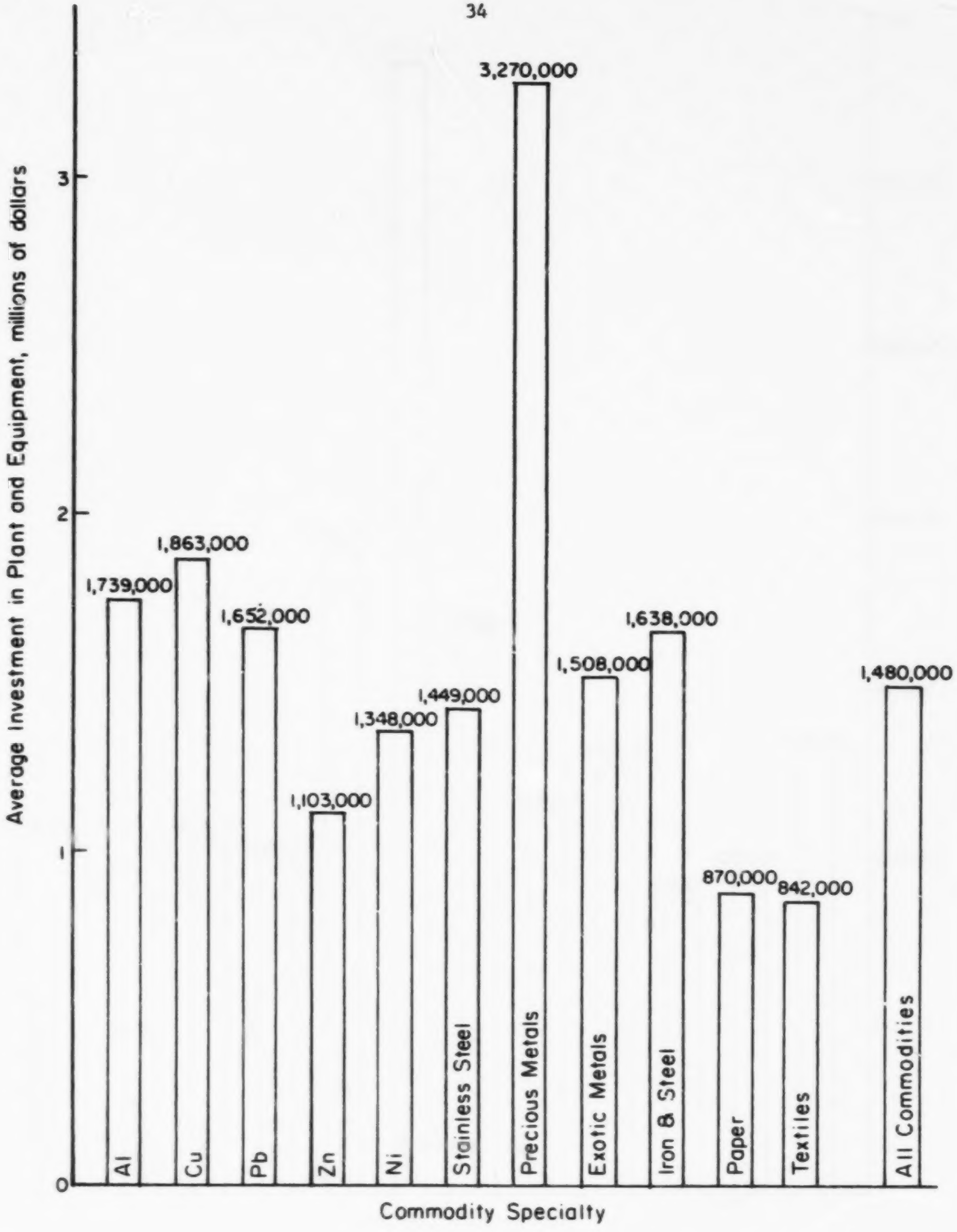


FIGURE 5. AVERAGE INVESTMENT IN PLANT AND EQUIPMENT BY RECYCLING COMPANIES, BY COMMODITY
Source: Extensive Survey

(66)

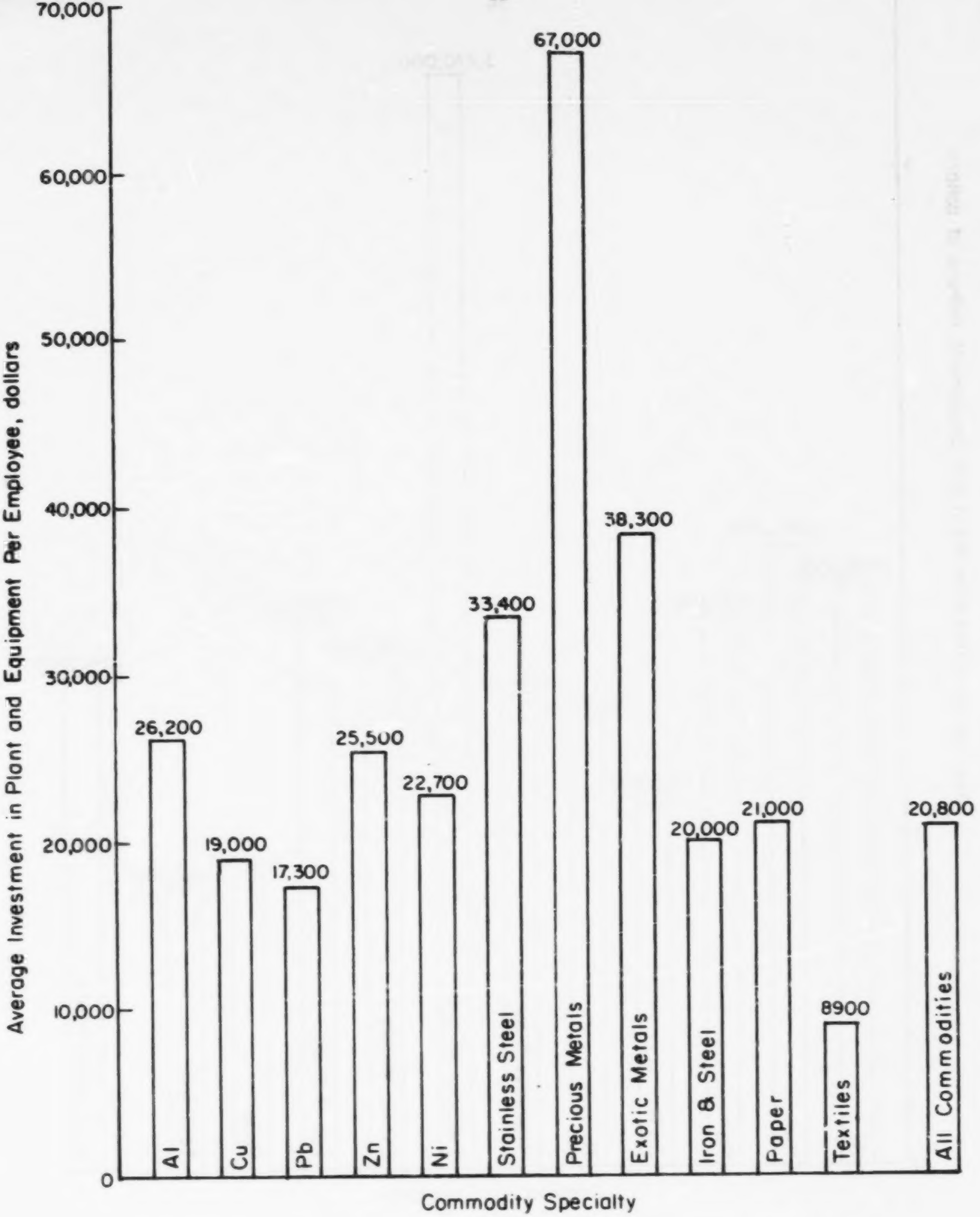


FIGURE 6. AVERAGE INVESTMENT PER EMPLOYEE BY RECYCLING COMPANIES, BY COMMODITY
Source: Extensive Survey

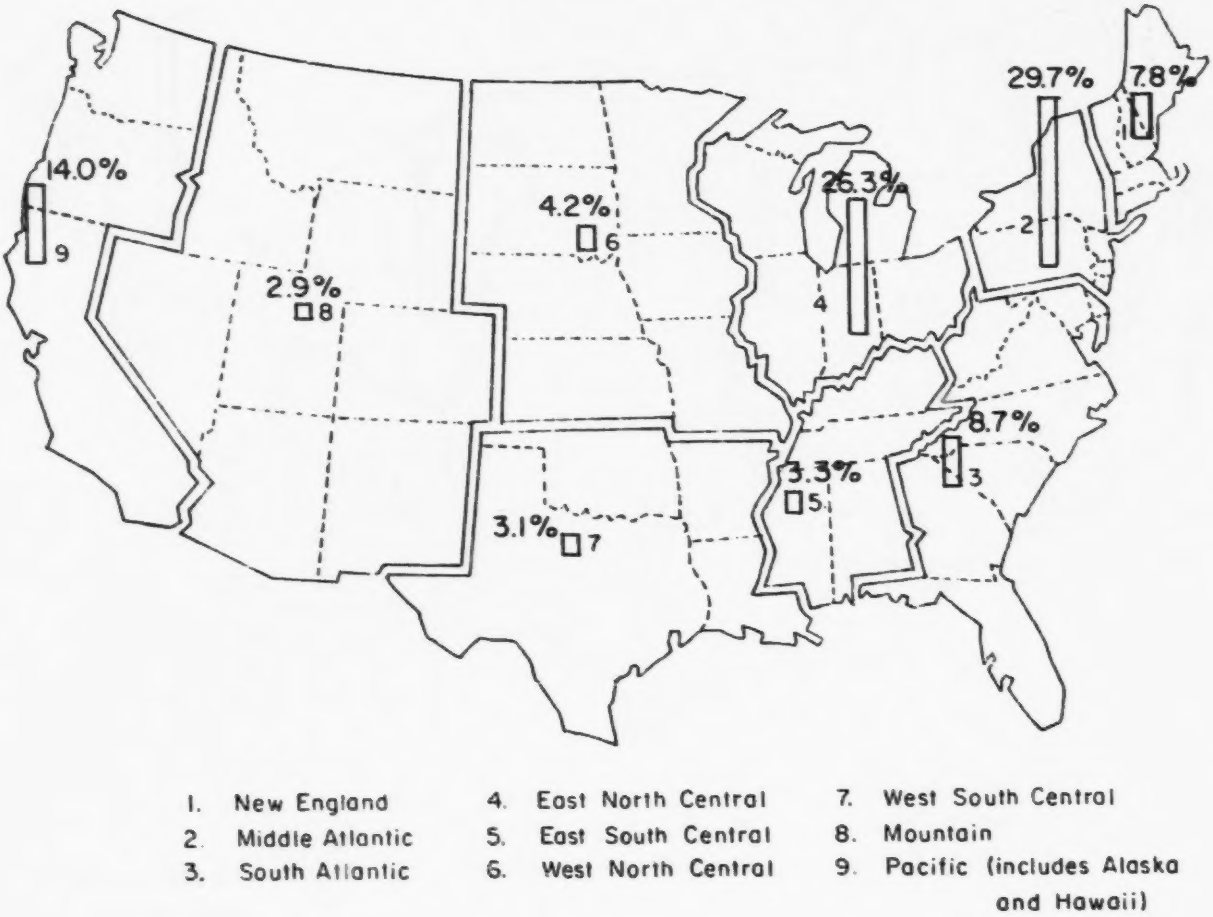
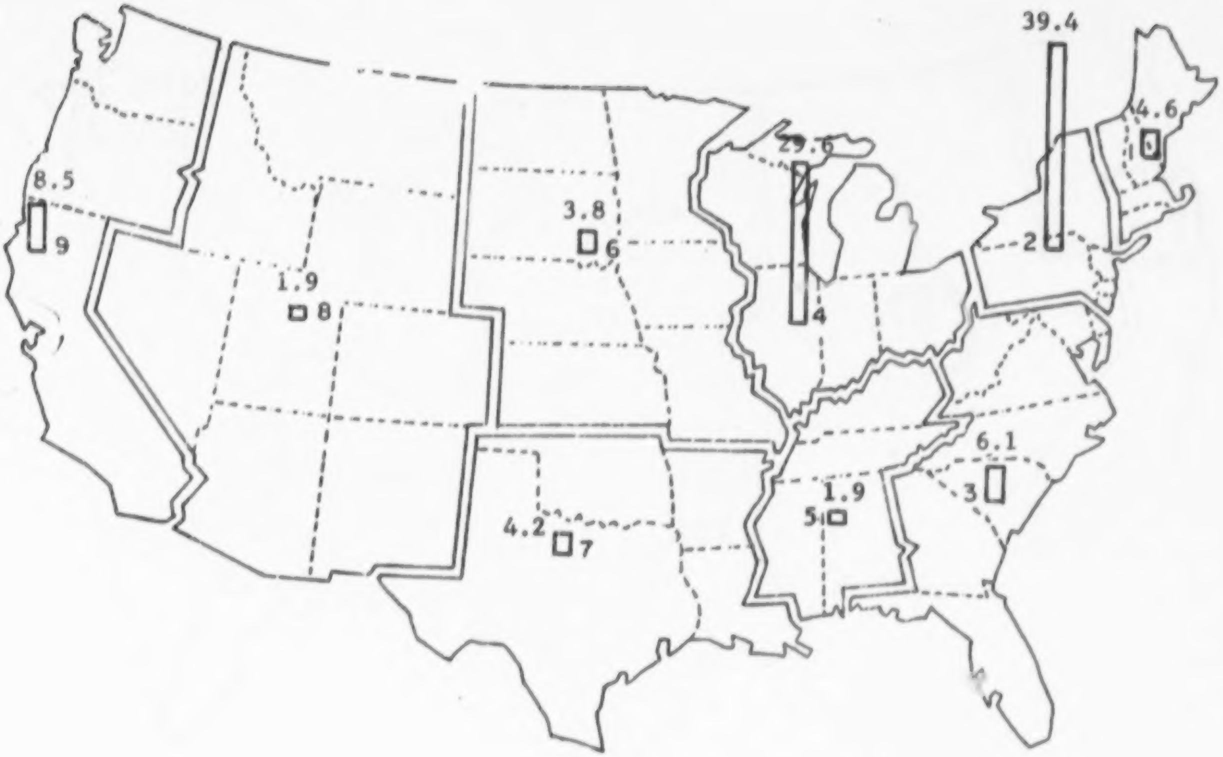

14.0%
9
2.9%
8
4.2%
6
3.1%
7
3.3%
5
26.3%
4
29.7%
2
7.8%
8.7%
3
1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

FIGURE 7. GEOGRAPHIC DISTRIBUTION OF THE RECYCLING INDUSTRY BASED ON NUMBER OF ESTABLISHMENTS
Source: Extensive Survey


39.4
4.6
1
29.6
2
8.5
9
3.8
6
1.9
8
4
6.1
3
1.9
5
4.2
7

1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

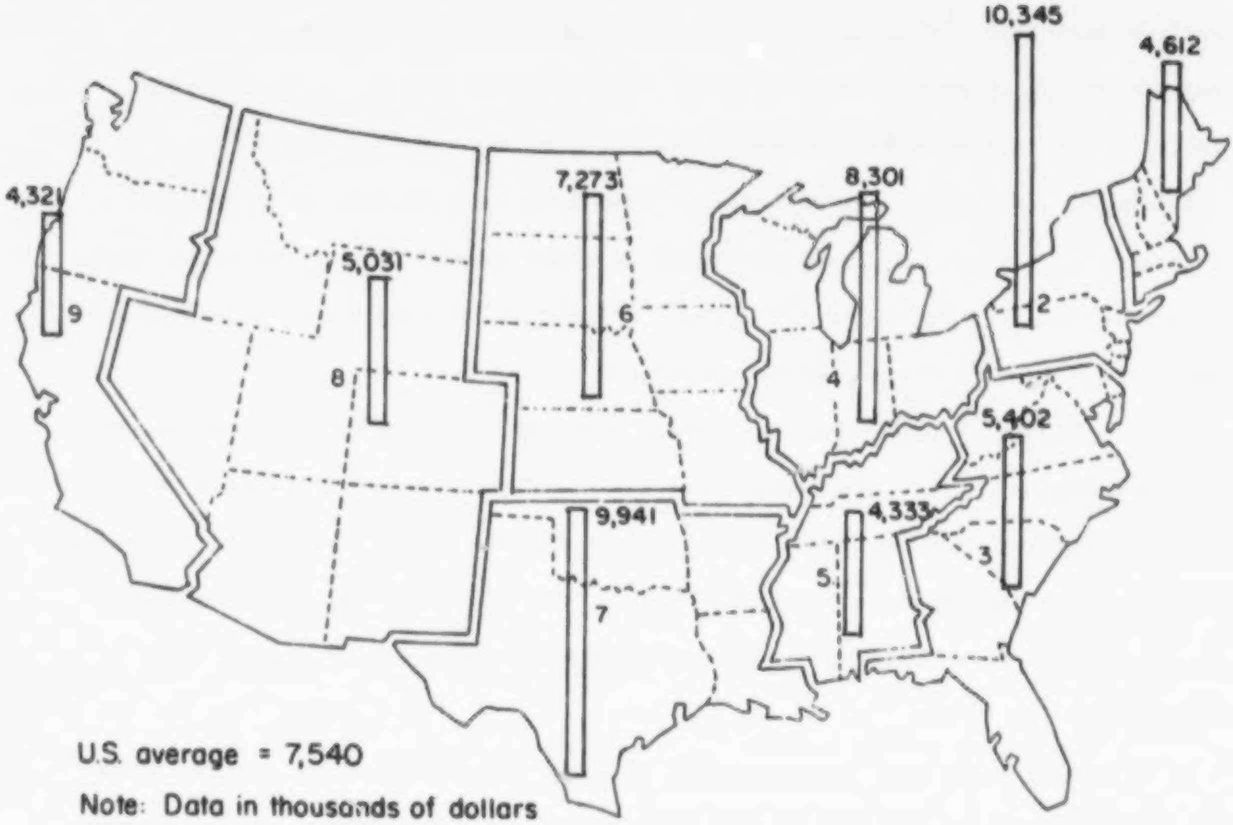
FIGURE 8. PERCENTAGE DISTRIBUTION OF RECYCLED MATERIALS SALES, BY REGION
Source: Extensive Survey

Figure 9 shows the average annual sales of recycling companies by region. The Middle Atlantic, East North Central, and West South Central (primarily Texas) regions with their large metropolitan areas and industrial concentrations support larger companies than the other regions which lack these two characteristics. The Pacific region actually has these characteristics (primarily in California) but light industries rather than materials processing industries dominate the region. The Pacific region is a net generator of scrap rather than a consumer of recycled materials. Thus, collection of scrap is relatively important, and this encourages smaller companies.

Figure 10 shows average company size, measured in terms of employment, for each region. There are variations of these data from the sales data of the previous figure. The next map, Figure 11, highlights these variations. It shows average sales per employee by census region. The sales per employee are lower in the South. Also, sales per employee in New England are much higher than elsewhere.

Figure 12 shows average value of plant and equipment by region. There is a wide spread between the low for New England and the high for the East North Central region. The value is larger for the industrialized Middle Atlantic and East North Central regions. The location of secondary smelters is another factor causing higher average investments in some regions.

Figure 13 shows average investment per employee on a geographical basis. The range of averages is extremely wide. The range of average investments per sales dollar shown in Figure 14 is even wider, but with a different pattern than investment per employee.


10,345
4,612
4,321
9
5,031
8
7,273
6
8,301
4
2
1
5,402
3
9,941
7
4,333
5

U.S. average = 7,540

Note: Data in thousands of dollars

1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

FIGURE 9. AVERAGE ANNUAL SALES OF RECYCLING COMPANIES, BY REGION
Source: Extensive Survey

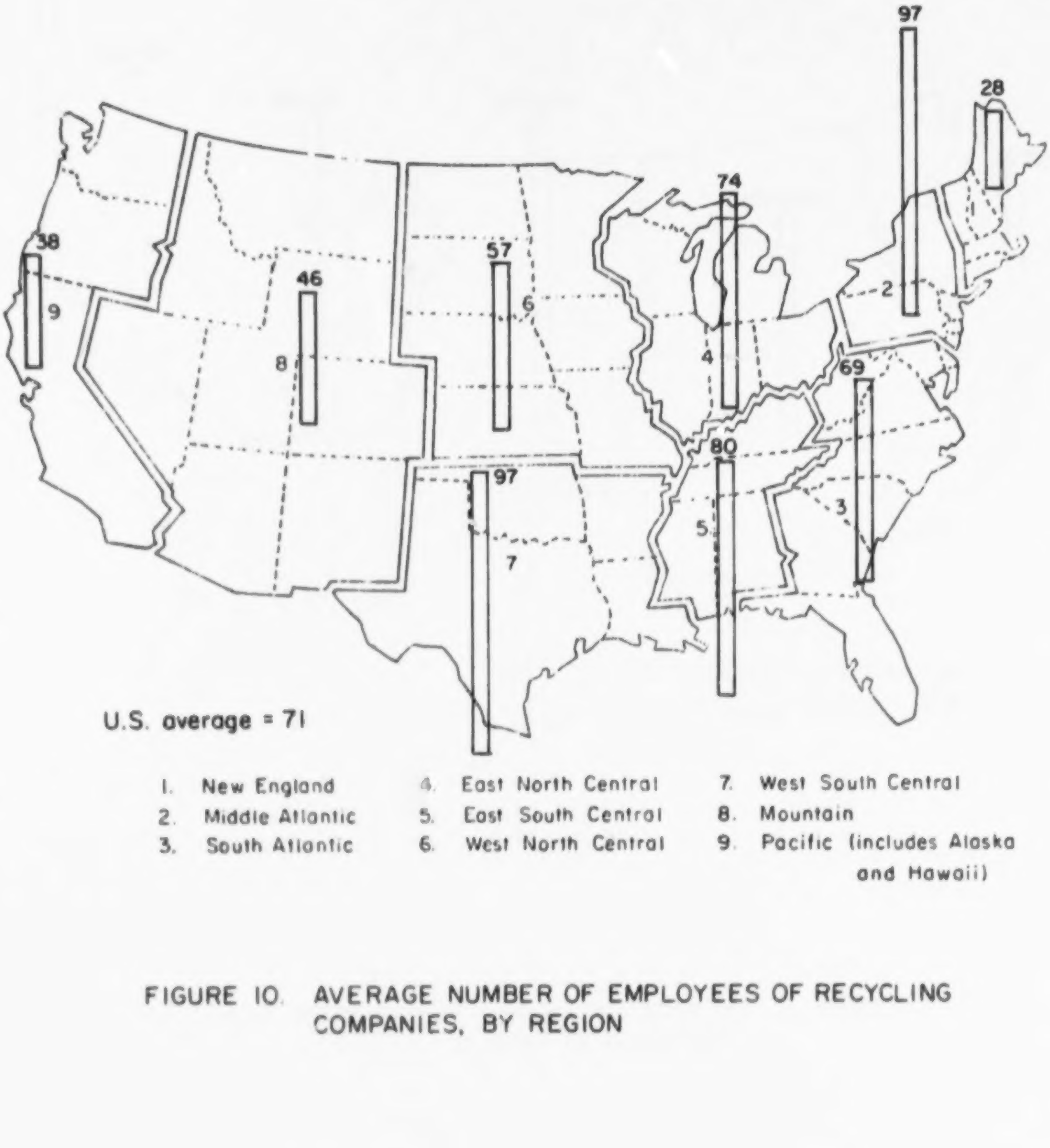
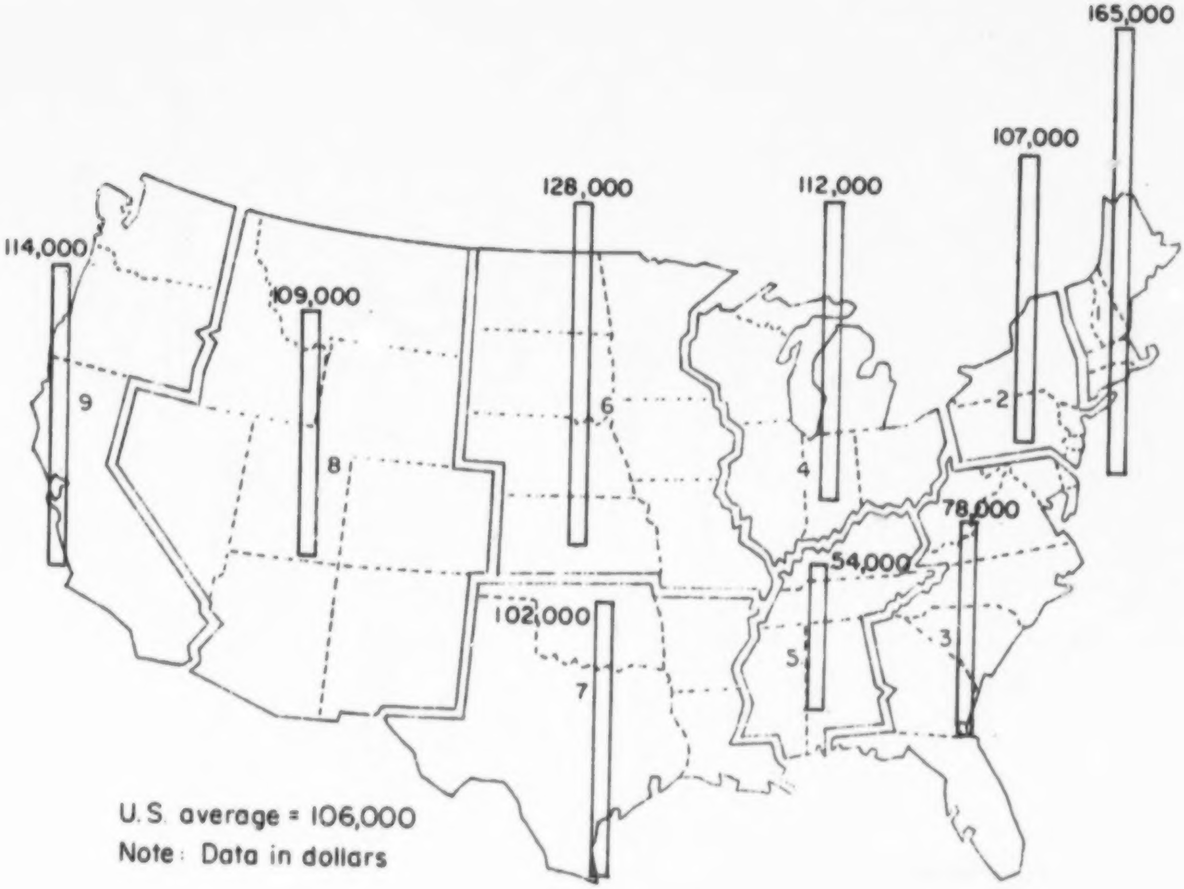

97
28
74
38
57
46
9
8
6
4
2
69
80
97
5
3
7
U.S. average = 71
1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

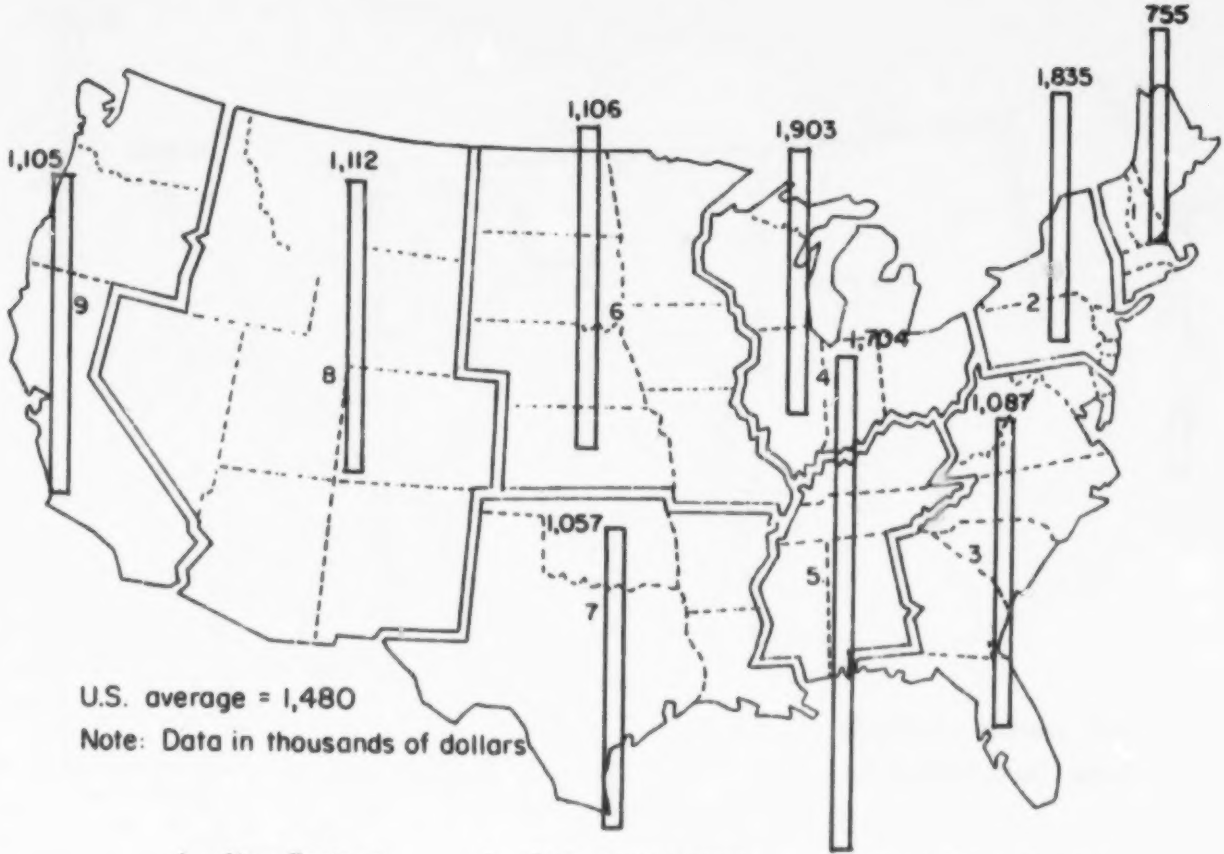
FIGURE 10. AVERAGE NUMBER OF EMPLOYEES OF RECYCLING COMPANIES, BY REGION


165,000
107,000
128,000
112,000
114,000
109,000
9
8
6
4
2
78,000
54,000
102,000
5
3
7

U.S. average = 106,000
Note: Data in dollars

1. New England	4. East North Central	7. West South Central
2. Middle Atlantic	5. East South Central	8. Mountain
3. South Atlantic	6. West North Central	9. Pacific (includes Alaska and Hawaii)

FIGURE 11. AVERAGE SALES PER EMPLOYEE OF RECYCLING COMPANIES BY REGION


1,105
9
1,112
8
1,106
6
1,903
4
1,704
5
1,835
2
755
1,087
3
1,057
7

U.S. average = 1,480

Note: Data in thousands of dollars

1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

FIGURE 12. AVERAGE VALUE OF PLANT AND EQUIPMENT FOR RECYCLING COMPANIES, BY REGION

Source: Extensive Survey

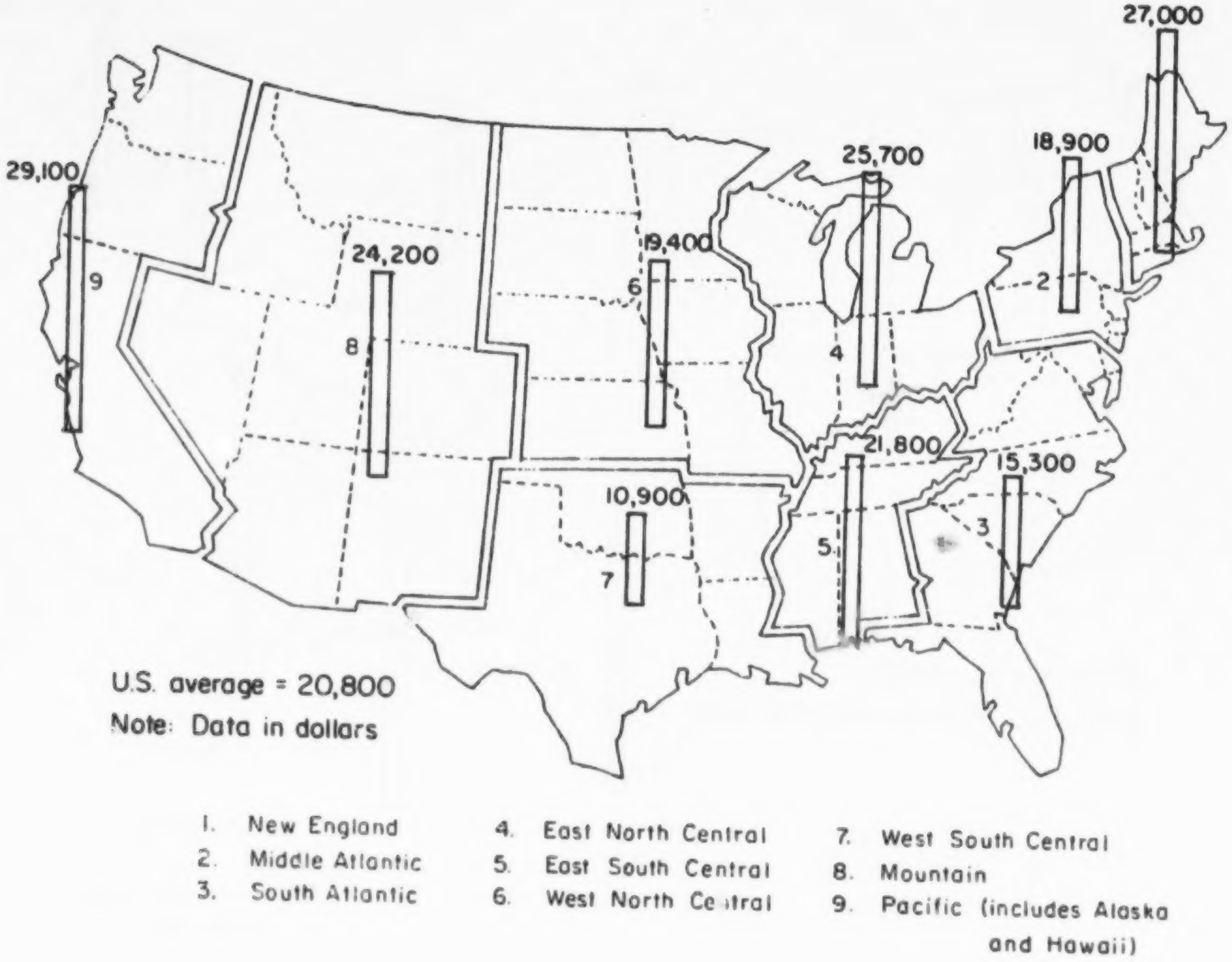
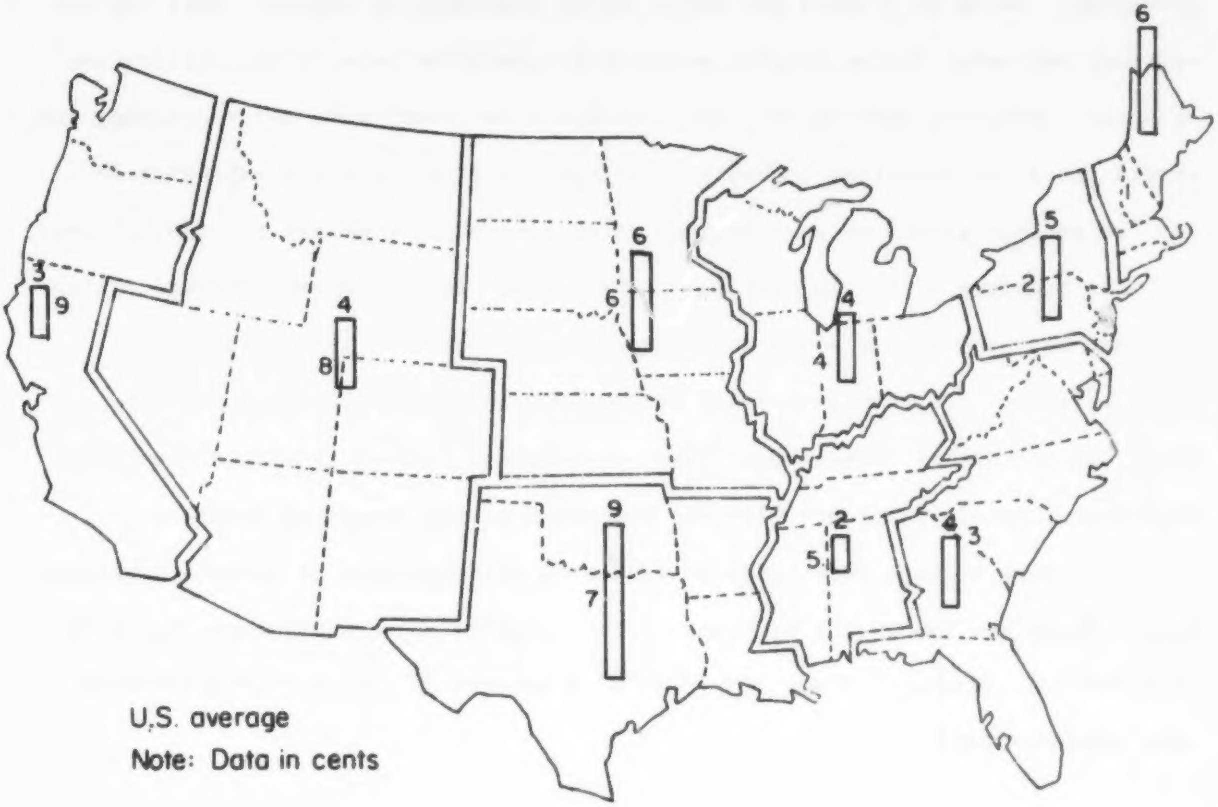

27,000
29,100
25,700
18,900
24,200
19,400
9
6
2
8
4
21,800
15,300
10,900
3
5
7
U.S. average = 20,800
Note: Data in dollars
1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

FIGURE 13. AVERAGE INVESTMENT PER EMPLOYEE FOR RECYCLING COMPANIES, BY REGION
Source: Extensive Survey


6
5
2
3
9
4
8
6
6
4
4
9
7
2
5
4
3
U.S. average
Note: Data in cents

1. New England
2. Middle Atlantic
3. South Atlantic
4. East North Central
5. East South Central
6. West North Central
7. West South Central
8. Mountain
9. Pacific (includes Alaska and Hawaii)

FIGURE 14. AVERAGE INVESTMENT PER DOLLAR OF SALES BY RECYCLING COMPANIES, BY REGION
Source: Extensive Survey

Potential for Recycling Industry Expansion

The investment per dollar of sales is low as shown in Figure 14 - averaging 2 cents to 9 cents per sales dollar depending on region. This low investment per sales dollar coupled with other considerations--fuller utilization of space, operating more shifts, the probable slow growth rate for recycling, etc.--should allow the recycling industry to afford the investment for expansion for any foreseeable growth rates. However, some companies, possibly the smaller ones, may have problems of raising capital. The smaller companies are indeed a critical part of the industry since such companies are vital to the collection of obsolete scrap. Fortunately, these collectors can expand substantially with little or no capital investment. Thus, on balance, lack of investment capital will not seriously interfere with the expansion of the recycling industry.

More serious deterrents to expansion are shortages of labor and management. These are two of the problems of the industry and are discussed later in this report. Easing of these shortages is essential if the recycling industry must expand rapidly.

Solid Waste Disposal Analysis

An analysis of solid waste generation and disposal practices of the recycling industry itself are presented in the next four figures. Solid waste is defined here as the relatively worthless materials generated in the processing of scrap. Figure 15 shows the importance of various types of solid wastes in terms of the percentage of companies that generate each type. The general waste category dominates with over 60 percent of the companies generating such waste. Included in this category are "rubbish", "trash", debris, garbage, "refuse", dusts, slags, and drosses. The other general category, "all other waste", includes packaging materials, baling wire, glass, brick, and similar items.

Among the specific waste items, paper waste and wood waste appear in large quantities. Iron and steel waste is intermediate. Textile waste, rubber tires, and wire insulation waste are low.

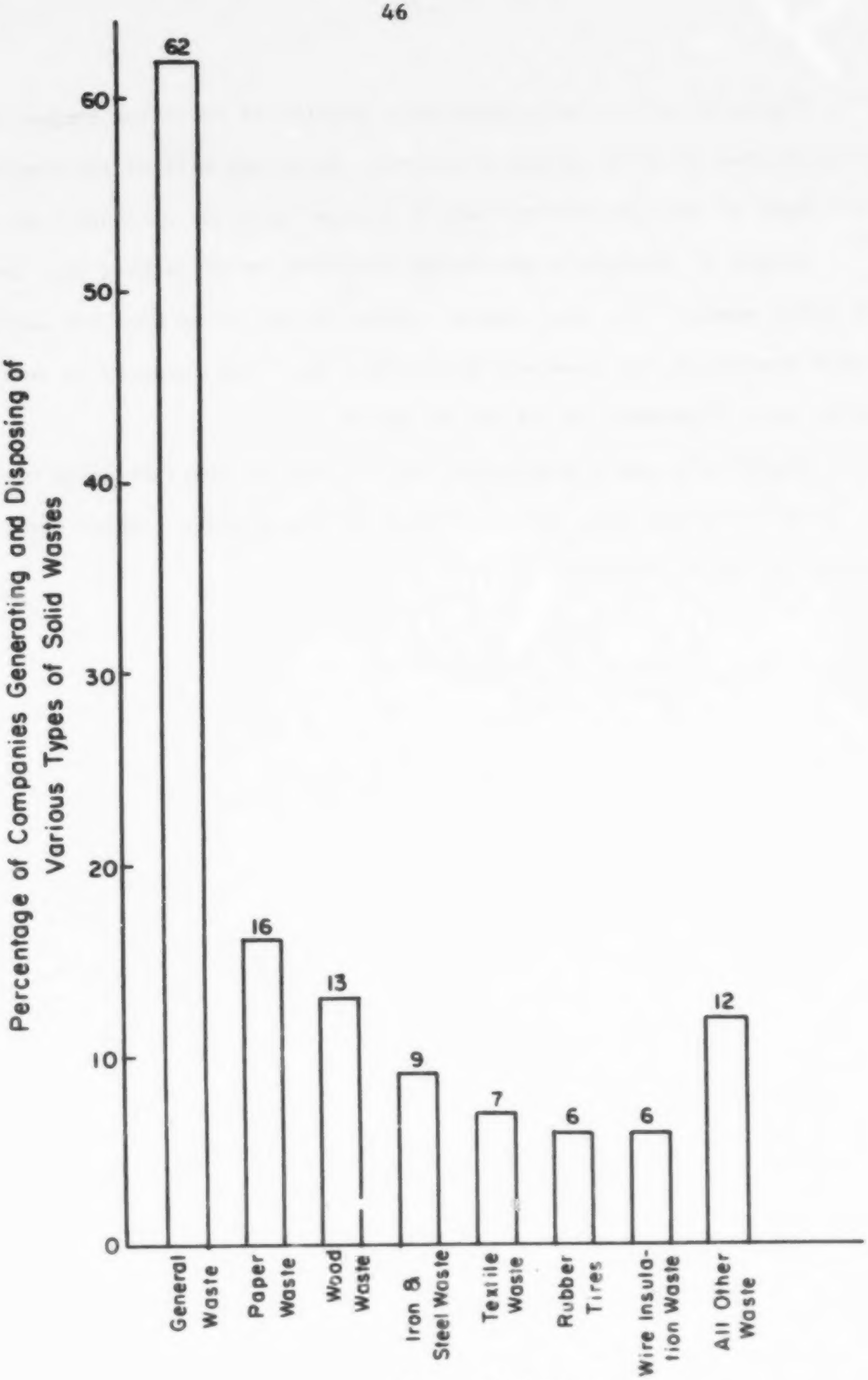


FIGURE 15. SOLID WASTES OF VARIOUS TYPES GENERATED AND DISPOSED OF BY RECYCLING COMPANIES
Source: Extensive Survey

Figure 16 gives a percentage distribution of recycling companies according to quantities of solid wastes generated. About one-half of the companies generate under 25 tons per month. Only 6 percent generate over 500 tons per month.

Figure 17 provides a percentage distribution of methods used for disposing of solid wastes. The most popular method by far is to haul the waste to a dump, with dumping on own premises in second place. The industry is fortunate to be able to sell 17 percent of its solid wastes.

Figure 18 gives a percentage distribution of costs of solid waste disposal. These costs are very small relative to annual sales - under one-tenth of one percent for most companies.

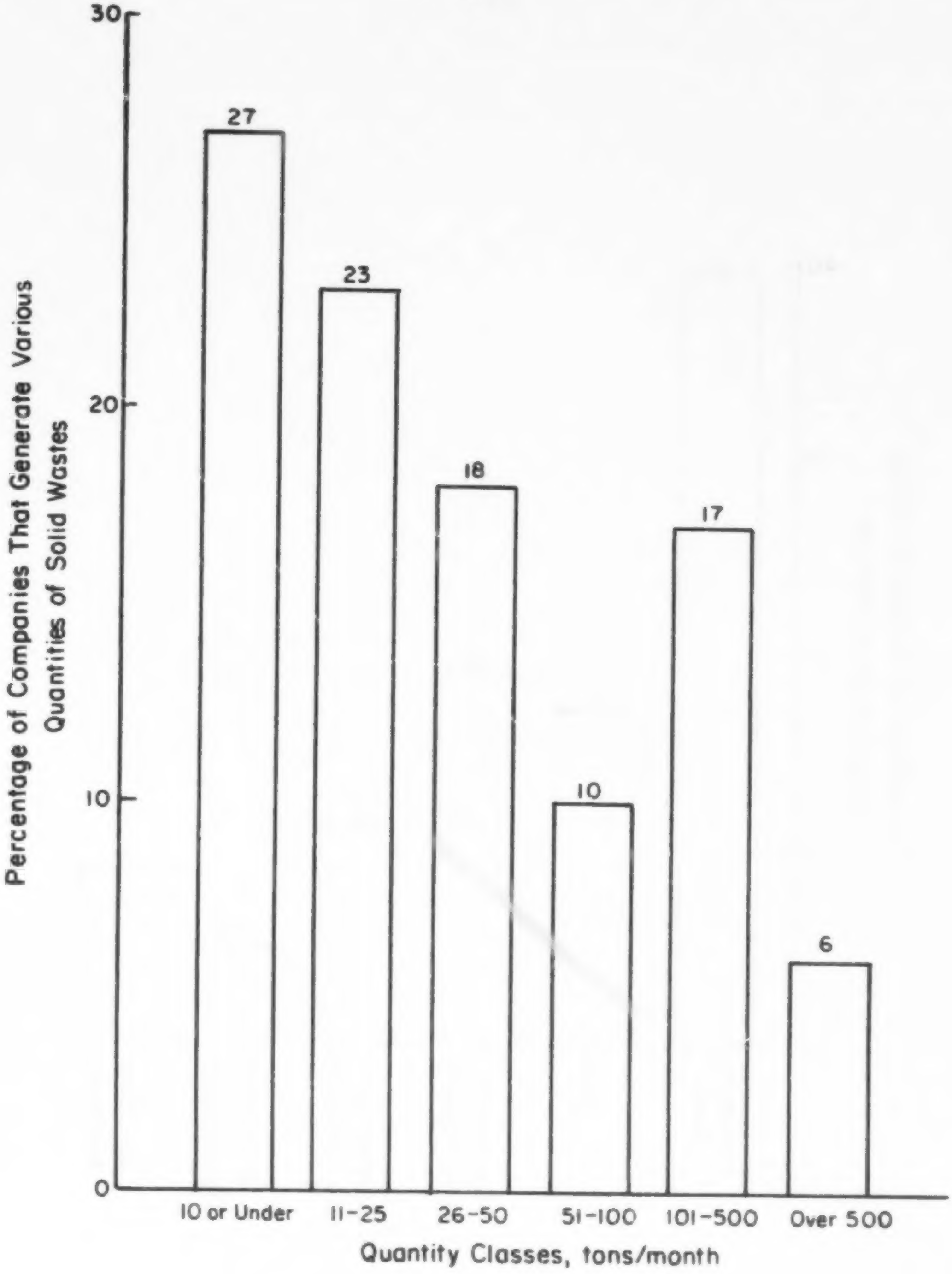


FIGURE 16. QUANTITIES OF SOLID WASTES GENERATED BY RECYCLING COMPANIES
Source: Extensive Survey

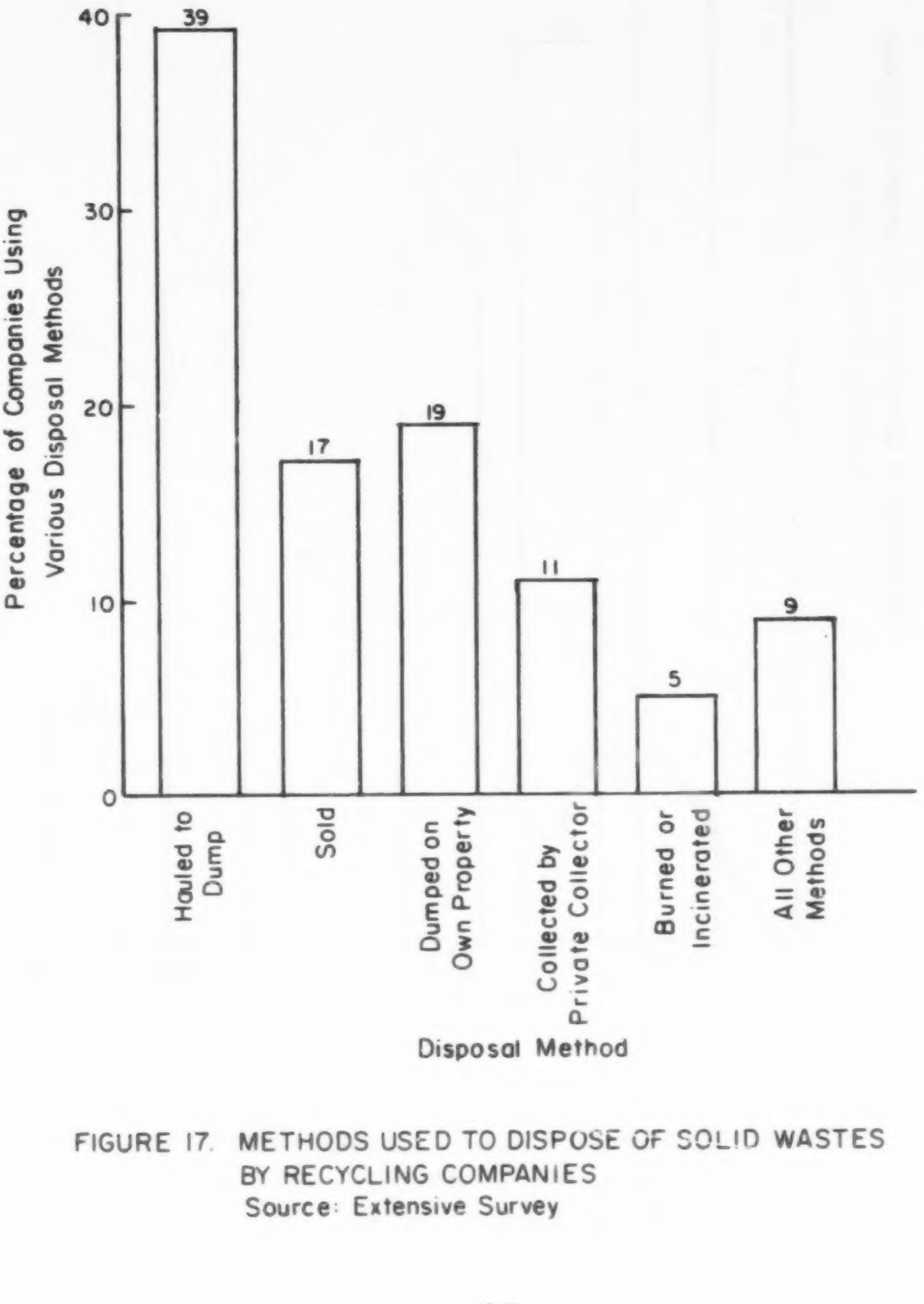


FIGURE 17. METHODS USED TO DISPOSE OF SOLID WASTES BY RECYCLING COMPANIES
Source: Extensive Survey

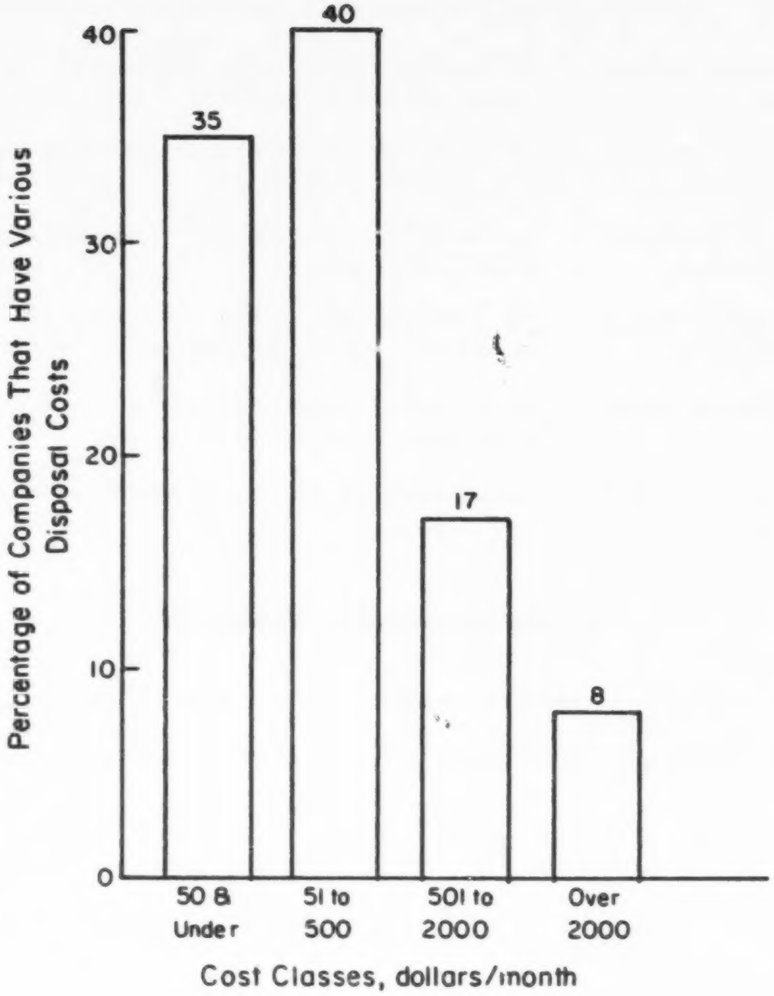


FIGURE 18. COST OF DISPOSAL FOR SOLID WASTES BY RECYCLING COMPANIES
Source: Extensive Survey

RECYCLING INDUSTRY PROBLEMS

The problems of recycling are presented here in several categories:

Problems of Specific Commodities: - summaries of the problems of individual commodities. For complete information concerning these problems, see the commodity reports of interest.

General Recycling Problems - Consumer Bias the problems concerning the markets on which recycled commodities are dependent.

General Recycling Problems - Materials: the problems concerning the quality and quantities of the recycled commodities.

General Recycling Problems - Industry Operations the problems concerning the operations of the recycling industry.

General Recycling Problems - Capital Equipment: the problems concerning the selection, acquisition, operation, and maintenance of production equipment.

General Recycling Problems - Legal: the problems caused by national, state and local Government actions.

General Recycling Problems - Transportation: a statement concerning transportation.

Problems of Specific Commodities

The individual commodity reports of this series analyze problems of each commodity. Included here is a summary of the more important problems of each commodity.

Problems of Recycling Paper and Textiles

Table 12 summarizes the major problems of paper and textile recycling. For additional information concerning these and other problems see Volume VII, Paper, and Volume VIII, Textiles.

TABLE 12. MAJOR RECYCLING PROBLEMS OF PAPER AND TEXTILES

Commodity	Problem	Effects	Recommended Actions
Textiles	Blends greatly reduce re-use of cotton.	Major reduction in textile recycle rate	(1) Develop new products and new uses of mixed blends, (2) Develop more economical methods of separation of fiber components.
	Recycling of wool limited because of foreign competition originally caused by wook labeling act.	Major reduction in textile recycle rate.	(1) Publicize use of recycled wool, (2) investigate repeal of Wool Labeling Act, (3) investigate federal incentives to encourage export of wool rags.
	Competition from urethane foams for cushioning has greatly reduced re-use of cotton mill wastes.	Major reduction in textile recycle rate.	(1) Investigate new markets for cotton mill wastes.
Paper	Relatively declining demand for products made from paperstock.	Major reduction in paper recycle rate.	(1) Support technical research to improve products and end-products, (2) develop strategies and educational programs, (3) push for nondiscriminatory purchase specs, (4) remove economic inequities (tax benefits, transportation rates, etc.) that impede recycled fiber usage.
	Erratic demand for paper stock	Major reduction in paper recycle rate.	(1) Improve methods of compacting, hogging, pelletizing of waste paper and paper stock.
	Lack of new products made from paper stock.	Major reduction in paper recycle rate.	(1) Support technical research in combining bulk waste paper with waste textiles or other materials, (2) generate ideas for new products and economic evaluation of them.

General Recycling Problems - Consumer Bias

Table 13 identifies and analyzes two general problems (poor image and irrational specifications) which restricts markets for secondary materials. These problems are pertinent to over half of the specific materials included in the study. The recycling industry has made progress toward solving both of these problems--more in the poor image one than in the irrational specification one. Continuation of present industry programs to improve image should take care of this problem.

The irrational customer specification problem requires additional effort. It is more difficult to solve than the image problem because it is involved with traditional practices of customers, and companies change their practices slowly. Also, Government specifications often are limited to primary materials.

General Recycling Problems - Materials

Table 14 describes and analyzes two general recycling problems associated with the materials to be recycled. The variations in type of scrap available are a continuing problem for the recycling industry--one of its major operating problems. But it is something that the industry has learned to live with because it must in order to stay in business.

The other problem in Table 14--nature of consumer solid wastes--is a completely different matter, and in a recycling sense it is a new problem. Only in the last few years has recycling been seriously considered as a major alternative to dumping, incineration, and sanitary landfilling for general consumer solid wastes. In magnitude it is a huge problem-- hundreds of millions of tons of consumer solid wastes are generated each year in the U.S. Technically it is formidable because (1) it is generated daily in family-size quantities; (2) it contains dozens of materials mixed together; and (3) the composition varies by location, time of year, day of the week, etc. This problem presents the greatest challenge and opportunity for the recycling industry. But is the most difficult one to solve.

TABLE 13. IDENTIFICATION AND ANALYSIS OF GENERAL PROBLEMS OF RECYCLING, CONSUMER BIAS

	Poor Image of the Recycling Industry	Irrational Customer Specifications and Discriminatory Government Procurement Policies
Problem Definition	1. Few people know what the recycling industry is or what it does. 2. Many people see junk yards and auto graveyards and believe these are all the recycling industry is. 3. There is the connotation in people's minds of inferior when they hear scrap or secondary.	1. Some government specs call for primary materials only. 2. Some specs are designed to make it difficult for recycled materials to meet them. 3. Specs sometimes change depending on how easy it is to get materials. 4. Some specs are overdesigned in terms of product requirements. 5. Those and other factors add up to considerable irrationality concerning specs for scrap and recycled materials.
Effects of the Problem	1. Recycled materials are sometimes priced slightly less than equal quality primary materials because of poor image. 2. Recycling industry is sometimes prejudiced against in local laws because of poor understanding of the economic and environmental functions of the industry.	1. Markets are reduced, and perhaps recycle rates slightly reduced, by irrational specs. 2. Smooth flow of materials is sometimes interrupted because materials are rejected by customer at one time that it would accept another time.
Problem Analysis	1. Because of the nature of their business, many scrap processors and secondary smelters have contributed to poor image by being unsightly operations and pollutors, plus being highly visible because located in high-population density areas. 2. Real and imagined poor business practices have contributed to poor image. 3. Present widespread interest in environment improvement and place of recycling in it offers a theme for image improvement.	1. Specs are sometimes unreasonable because primary people influence writing of specs. 2. Some users of materials write specs prejudicial to recycled materials to reduce risks. (Although some recycled materials are of low quality, most are not.) 3. It is difficult to get specs rationalized in face of large, well-organized primary companies, and antisecondary attitudes of some users of materials. Pressure from the social and environmental side may chage this. 4. Labeling laws (virgin-processed wool for example) tend to limit the market for recycled wool. 5. Very little affirmative action relative to recycled materials has been proposed. New York City is an exception to this as are some agencies of the Federal Government.

TABLE 14. IDENTIFICATION AND ANALYSIS OF GENERAL PROBLEMS OF RECYCLING, MATERIALS

	Changes in Types of Scrap Available	Nature of Consumer Solid Wastes
Problem Definition	1. Changes in manufacturing technology cause changes in types of scrap produced.	1. Consumers generate large quantities of solid wastes of all types.
	2. Changes in consumption patterns cause changes in types of scrap generated.	2. These are usually mixed together for disposal as municipal refuse.
	3. Manufacturers redesign products only for increased marketability, never for recyclability.	3. Composition will very considerably from day to day and month to month.
	4. Thus, the types of scrap available to the scrap processer changes.	4. Percent composition of the mixed wastes varies greatly according to material--as high as 70 percent for paper, often only 1 percent of some metals.
		5. Thus, the nature of consumer solid wastes make recycling difficult
Effects of the Problem	1. Recycling companies must adjust to changing scrap--thus increasing operating costs and risking changes in output composition.	1. Most consumer solid wastes do not get recycled because disposed of in mixed refuse.
	2. Sometimes more solid wastes are generated by recyclers because of mixtures.	
Problem Analysis	1. Recycling company must be versatile to adjust to changes.	1. Nature of consumer solid waste is as it is for consumer convenience and to minimize collection costs.
	2. New uses for materials might minimize problems.	2. Unlikely that consumer can be forced to segregate.
	3. Increases importance of looking ahead by recyclers so no knows what problems are coming up.	3. Unlikely that municipal refuse agencies are interested in multiple pickups of segregated wastes.
		4. Government-subsidized R&D is underway on separation and recycling of consumer solid wastes. (For example, a Black-Clawson System in Franklin, Ohio).

General Recycling Problems - Industry Operations

Table 15 defines and analyzes four general recycling problems that concern the operations of the recycling industry. They are all serious operating problems for many recycling companies, yet they are not unique to the recycling industry. Many industries face these same problems because of changes occurring in the U.S. economy - rapid technological advancement, changing social values, and changes in economics. The general solution to this group of problems is for the recycling industry to continue being aggressive and responsive to change in order to fit existing conditions.

General Recycling Problems - Capital Equipment

Table 16 describes and analyzes three general problems of recycling that concern the capital equipment of the industry. These all reflect changes that are occurring in the recycling. More processing of more material requires more capital equipment. And usually more complex and expensive equipment. Many of the recycling companies have learned to purchase, operate, maintain, and finance modern equipment. Many others still have much to learn.

Manufacturers of equipment have not done a good job in the past of making needed equipment available. Some have now learned that this is a developing market for such equipment and are directing design and marketing efforts toward the recycling industry. Much remains to be done in making proper equipment available.

When discussing processing equipment and problems associated with its purchase, installation and use, it should be noted that processing costs represent a very small proportion of total costs (as low as 5 or 10 percent) to many processors. It is not surprising then that many processors have regarded equipment as a low priority part of their business.

TABLE 15. IDENTIFICATION AND ANALYSIS OF GENERAL PROBLEMS OF RECYCLING INDUSTRY OPERATIONS

	Labor Availability	Management Availability	Rapid Changes in Nature of Recycling Business	Need for Increased Specialization in Recycling Industry
Problem Definition	1. Some recycling industry companies have trouble hiring labor. 2. Some recycling industry companies have high labor turnover levels. 3. Some recycling industry companies are not able to get satisfactory performance from labor. 4. Absenteeism is high among many recycling companies.	1. Most recycling industry companies are family owned and managed (but some are publicly held corporations). 2. Traditionally sons, sons-in-law or other younger generation relatives become managers as needed. 3. Now there is a strong trend toward too few younger generation relatives being interested in getting into the recycling industry. 4. Non-family-of-owners men have not generally been interested in management jobs in the recycling industry. 5. The above factors combined have created scattered shortages of management in the recycling industry that may become worse in the near future.	1. Recycling industry trend is away from commercial type business (trading) to manufacturing type business (processing). 2. Investment costs are increasing because of need for analysis instruments, pollution control devices, better preparation of scrap, etc. 3. More specialized management is needed to handle the more important processing being done, growth in size of operations, more planning, etc. 4. More skilled labor is needed to operate and maintain more and more complex equipment.	1. Specialization of recycling industry companies according to materials, types of processing, etc. are minimal. 2. Specialization can offer economies of scales, higher quality output, and other advantages. 3. Specialization may reduce the size of investment required for a given dollar volume of business.
Effects of the Problem	1. Interrupts smooth flow of recycling operations. 2. Causes off-spec output	1. Shortages of competent management causes recycling inefficiencies that can disrupt flow of materials. 2. Shortage of younger innovative managers delays finding processing improvements that could increase recycle rates if they were developed.	1. Many companies are having trouble adapting to changes, thus causing dislocations in flow of materials. 2. Some companies are unable to meet quality standards of materials because they are not adapting to changes.	1. Investment costs can be very high to handle all types of scrap. 2. Efficiency can be low because of smaller volume in several materials. 3. Quality may be lower for non-specialist that knows each material less well than specialist.
Problem Analysis	1. One cause of labor problems is wages that are not competitive with other industries. 2. A more important cause is poor working conditions. 3. Another cause is a stigma about working for scrap processors. 4. Another cause is ineffective recruiting of labor by many of the recycling industry companies. 5. Since recycling industry is labor intensive, labor availability is highly important to operations. 6. Also, shortage of labor is a spur to labor-saving methods of processing.	1. Younger generation relatives of recycling industry company owners find other industries more attractive. 2. Because so many companies are family owned and managed, this greatly reduces manager prospects where this has been the traditional source. 3. In the past the opportunities for non-owner families were limited in the recycling industry because most management came from younger-generation owners. 4. Many opportunities now exist for "outsider" managers, but the industry has not been effective in making this known and thus, has been unable to recruit sufficient managers.	1. Changes are caused by: . larger volumes of recycled materials being handled. . more interest by scrap generators in maximizing income from sales of scrap. . more interest by scrap users in getting best material for their specific uses. . recognition by some scrap processors that they can profit from modernization. 2. It can be extremely difficult to keep up with rapid changes, although the industry is trying. 3. Many companies within the industry realize that the industry is changing rapidly and are adapting.	1. There was little or no need to specialize in past because investment was low, secret of success was ability to buy and sell, and there were fewer compositions of materials. 2. These factors are becoming less true, and processing is becoming more important. 3. Often processing, as with other types of production, is specialized as to methods and equipment. 4. Specialization is needed now, but this results from changes in the nature of the recycling industry.

TABLE 16. PROBLEMS RELATED TO THE
USE OF CAPITAL EQUIPMENT

	Lack of Know-How in Purchasing, Installing, Using, and Maintaining	Cost and Financing	Availability
Problem Definition	1. Due to industry cost structure, equipment utilization has not been a high priority item. 2. Industry, in general, is not process or production oriented. 3. Without knowledge or competent advice equipment purchases may tend to be irrational or defensive.	1. Much of the required equipment is expensive (over $50,000). 2. Difficult for small or medium size firms to obtain adequate financing of this magnitude.	1. Equipment to perform some tasks not available or if available is not adequate. 2. Equipment in many cases too inflexible for general use.
Effects of the Problem	1. Operations not efficient. 2. Maintenance costs higher than need be. 3. Some purchased equipment not suited to do the job that is required. 4. Productivity lower than could or should be.	1. Many firms do not buy equipment they require. 2. Tend to buy cheaper and less desirable equipment than they should. 3. Many firms must use old equipment that is unreliable. 4. Industry is not as efficient as it could be.	1. Manual labor required but not available. 2. Unable to process some raw material economically.
Problem Analysis	1. There has been a lack of engineering type personnel in the industry. 2. Industry is reluctant to seek out consulting engineering assistance with problems involving purchase, installation, and operation of equipment. 3. Little interchange of ideas among industry members. 4. Individual firms may purchase much equipment they do not need or which is not economical. 5. Mutual distrust between scrap industry and the equipment manufacturers. 6. With better process and production know-how industry could economically recycle more scrap.	1. Cyclical business trends plus lack of firm markets in future may make securing of financing difficult. 2. Availability of adequate and reasonable financing could enable many firms to update their operations and thus increase their recycling capacity and capabilities.	1. Some equipment is only applicable to large volume operations 2. Market for scrap processing and handling equipment may not be large enough to attract research money. 3. Scrap industry slow to adopt processing innovations. 4. Equipment or process innovation developed at the processor level is seldom shared with other processors. 5. If proper equipment was available at reasonable cost, more scrap could be recycled.

General Recycling Problems - Legal

Table 17 describes and briefly analyzes four general problems of recycling relative to governmental influence and legislation. Two of the problems relate to national materials policy (depletion allowances and Government stockpiling) which directly affect primary metals and primary producers but because of the market competition between primary and recycled materials also affects recycling. The magnitude of the effect of these two policies on recycling has not been specifically determined.

One of the problems reflects a historical image of the recycling industry and recycled materials in general. The generally false "junk collector" image of the industry and a perpetration of the false idea that "secondary" refers to quality as well as source has resulted in unwarranted discrimination against the industry (licensing requirements and zoning laws) and its products. As discussed earlier in this report in the section titled Governmental Influence on Solid Waste Utilization and Recycling, licensing and zoning statutes are usually restrictive in nature and in some cases discriminatory and/or arbitrary in focus. It is the smaller recycling company who is most affected. These firms are least likely to be able to afford unreasonable corrective actions or to relocate outside the cities they serve. Their very valuable function, the collection and processing of lower grades of obsolete scrap, may be reduced or eliminated thereby worsening municipal solid waste problems.

The fourth problem relates to changing pollution codes which represent a very real problem to the melters and refiners of recycled materials especially and to the whole processing industry in general.

TABLE 17. IDENTIFICATION AND ANALYSIS OF GENERAL LEGISLATIVE PROBLEMS

	Depletion Allowances	Pollution Codes	Discriminatory Classification, Licensing, and Restriction of Scrap Processors	Stockpile Policy
Problem Definition	1) Primary material industries receive an allowable deduction (15 percent of sales revenue in case of metals) from taxable income. 2) Capital gains advantage also accrues such as to the timber growing industry.	1) Pollution codes are often changed every few years. 2) Codes are different in various parts of the country. 3) Codes are set up by three levels of government causing confusion. 4) Federal codes encourage states to enact stricter codes.	1) Scrap industry classified as a nonmanufacturing industry. 2) Scrap industry is licensed and restricted based on the name of the industry and not on merit.	1) Federal government stockpiles a significant quantity of strategic materials as a hedge against nonavailability during national emergency. 2) Stockpile requirements are often changed in a rather irrational and unpredictable manner resulting in buying and selling by the government.
Effects of the Problem	1) Creates an unfair advantage in favor of primary materials. 2) Encourages mining companies to sell increased volume of primary metal. 3) Results in misallocation of resources.	1) Creates an unfair burden on some segments of industry while other segments are not affected. 2) Creates unfair advantage to firms in certain geographic areas or states.	1) Industry does not get many of the operating tax breaks (sales tax exemption) accorded to most manufacturing industries. 2) Industry (by name--not function) is zoned out of areas zoned for manufacturers in some localities.	1) Stockpile policy may cause fluctuations in the primary metal markets which also affects the secondary industry.
Problem Analysis	1) Depletion allowance was originally adopted to encourage exploration and development of natural resources. 2) Currently viewed by many as simply a discriminatory tax break for the natural resource industries. 3) Those companies producing both primary and secondary materials are encouraged to produce and sell primary to obtain depletion allowance. 4) Effect on recycling is adverse, but no quantitative data are available.	1) Companies are sometimes faced with having to replace pollution control equipment before old equipment is fully depreciated. New 60-month depreciation rule should help here. 2) It is advantageous to be located in an area with less strict pollution codes.	1) Scrap processor, in many cases, classified on the basis of a historical image of the scrap industry; i.e., the junk collector image. 2) Scrap processing industry classed as retail or wholesale business rather than a manufacturing business.	1) Timing of increases or decreases in stockpile objectives often reinforces (rather than smoothing) cyclical swings in market conditions which causes serious problems for some metals. 2) Many problems associated with stockpile policy are a result of changes in policy and not the policy itself. 3) Magnitude of the affect on recycling is not known.

General Problems - Transportation

One other area deserves special mention. This is, the area of freight rates, freight rate policy and transporation of processed scrap in general. There are four general problems associated with the transportation of processed scrap: these are (1) high cost of shipping low value material, (2) difficulty in obtaining railraod cars when needed, (3) poor service, and (4) pilferage or loss of high value materials during shipment. The last three items are largely subjects for direct negotiation between shipper and carrier, and coordinated action by affected groups of shippers. The first item includes the possibility of discriminatory freight rates, or at least, rates that do not promote recycling especially of low unit value waste materials.

Paper and textile wastes and some metal residues are particularly affected by the high cost of shipping. The shipping costs in many cases may exceed the value of the material being shipped. This situation, of course, is true of other low-priced commodities such as sand and gravel, but in the case of processed wastes, they are raw material forms competing with virgin materials for markets. If freight rates do, in fact, discriminate against processed waste materials, recycling would be inhibited.

During the course of this study several instances of apparent rate inequities were brought to the attention of the research investigators. Many of them concerned the rates for pulp compared with those for waste paper. In the cases reported, the rates for waste paper were 80 percent to more than 100 percent higher than the rates for pulp between the same points. Ocean freight rates for waste paper are also higher than for pulp. In the metals area, examples were cited where rates for scrap were measurably higher than rates for ores and concentrates. In the case of textile wastes there are no real competitive raw materials for comparison. However, an example was given where the freight rate for textile wastes from city "A" to city "B" for consumption in that city were lower than the rate between the same points when the waste material was for export from that city.

The Battelle research staff was not in a position to fully investigate nor evaluate these reported instances of freight rate discrimination. Also, it was not possible to establish the magnitude of the problem in terms of the amounts of waste materials not recycled because of transportation problems. It is recommended, however, that the appropriate regulatory bodies be encouraged to review the question of freight rate discrimination and the effects on waste materials, and beyond that, consider the question in terms of a total materials policy for the nation.

GENERAL COURSES OF ACTION

The courses of action recommended for problems specific to the various commodities are given in the respective commodity reports, and is mentioned in Table 12. This section of the general report considers only the general problems of recycling.

Evaluation of Problems

The fifteen general problems of recycling are not all of equal importance. It is necessary to evaluate the differences among them in order to assign priorities for actions.

The method used is based on how the fifteen compare with each other when scored with three criteria:

- Solution of the problem will improve the environment
- Solution of the problem will conserve natural resources
- Realistic solutions can be found.

In the content of this report, the first of these criteria is believed to be more important than the other two. It is weighted to allow a high score equal to the total of the other two.

Table 18 presents the results of the evaluation of the fifteen problems using the three criteria. This is the consensus scoring of five individuals. In this evaluation, five of the problems have total scores higher than the other ten:

- Irrational customer specifications and discriminatory Government Procurement Policy
- Nature of consumer solid wastes
- Lack of know-how concerning equipment
- Availability of equipment
- Depletion and other tax allowances for primary materials.

TABLE 18. EVALUATION OF FIFTEEN GENERAL PROBLEMS RELATED TO RECYCLING

	Criteria and Scores			
Problems	Solution of Problem Will Improve Environment	Solution of Problem Will Conserve Natural Resources	Realistic Solution Can Be Found	Total Score
	(10)	(5)	(5)	(20)
Poor Image of the Recycling Industry				10
Irrational Customer Specifications and Discriminatory Government Purchasing Policies				14
Changes in Types of Scrap Available				7
Nature of Consumer Solid Wastes				12
Labor Availability				9
Management Availability				10
Rapid Changes in Nature of Recycling Industry				9
Need for Increased Specialization in Recycling Industry				11
Lack of Know-How Concerning Equipment				13
Cost and Financing of Equipment				10
Availability of Equipment				12
Depletion Allowances for Primary Materials				13
Pollution Codes				11
Discriminatory Classification of Recycling Industry				8
Government Stockpiling Program				9

NOTE: This type of form was completed by each evaluator. Each column was completed, then each row was totalled. The scores shown in the last column are averages of all evaluators.

These five problems are rated as high priority. Actions for solving them should be fully investigated before considering the ten lower priority problems.

Recommended Actions

Battelle-Columbus' recommendations for concerted actions of handling these problems are divided into two groups according to priority - high priority and lower priority.

High Priority Actions

The high priority actions recommended here are important and far-reaching enough to be in the public interest. Thus, participation by EPA is desirable. Participation by NASMI and its members is definitely desirable since the problems and actions are predominately within the boundaries of the recycling industry.

Table 19 presents the recommended action programs for the high priority recycling problems. The first problem listed, irrational customer specifications and discriminatory Government procurement policies is one that can best be solved by individual and collective industry efforts. This involves two basic activities - insuring that recycled materials do meet customer specifications, and educating customer as to the benefits of making specifications realistic.

The second problem concerning the nature of consumer solid wastes is of great interest to EPA, and offers the potential of new recycling opportunities for the recycling industry. Methods and approaches to this problem lack an overall viewpoint. It is expected that one or more overall systems will be developed in the next few years, and that recycling will play a part in such systems.

TABLE 19. RECOMMENDED ACTIONS, HIGH PRIORITY GENERAL PROBLEMS

	Irrational Customer Specifications and Discriminatory Government Procurement Policies	Nature of Consumer Solid Wastes	Lack of Know-How for Buying, Using and Maintaining Equipment	Availability of Equipment	Depletion Allowances for Primary Material
Recommended Actions	1. Insure that scrap and recycled materials always meet specifications. 2. Promote the high quality of scrap and recycled materials. 3. Encourage users to use realistic specifications. 4. Change government purchasing and procurement policies to encourage use of secondary materials. 5. Examine effect of labeling laws on recycling--modify laws if necessary.	R&D to recover valuable materials from mixed municipal refuse.	1. Education of the owners, users, and operators on the important aspects of equipment selection and utilization. 2. Encourage industry members to discuss through their trade association their equipment problems and solutions with other members of the industry. 3. More cooperation between manufacturers and users of equipment.	1. Encourage research and development of needed equipment. 2. Coordination between scrap processors and manufacturers to translate needs into specific equipment designs and developments.	1. Determine the effect of depletion allowances on recycling and the recycling industry. 2. Take action based on the results of a comprehensive study.
By Whom (1)(2)(3)	NASMI/NASMI Members/ Government Officials	EPA/NASMI	N - NASMI I - Individual scrap processors E - Equipment manufacturers	N - NASMI I - Individual scrap processors E - Equipment manufacturers	EPA/NASMI
Specific Steps	1. NASMI introduce a policing action to insure quality of products of NASMI members. 2. Expand promotion of recycled material on overall and specific commodity basis. 3. Tie promotion to environmental improvement movement. 4. Demonstrate to customers that reasonable specifications make economic sense to them.	1. NASMI undertake a comprehensive study of the municipal refuse situation, and recycling's place relative to it. 2. Based on the investigation, plan the role of the recycling industry in the total municipal refuse picture. 3. Set up a task force of members and nonmembers to analyze the economics of various alternative and combinations of handling, separation, recycling, disposal, etc., of municipal refuse and its components. 4. Take a leadership position in unifying and rationalizing the whole municipal refuse situation on a sound economic basis.	1. Initiate a program of equipment utilization seminars conducted by the manufacturers, consulting engineers, and experts from the scrap industry. (N) 2. Institute a formal procedure for compiling problem-solution case histories on process and equipment utilization. (N) 3. Recruit capable engineering personnel familiar with equipment and its operation on an industry wide basis. (N,I) 4. Organize and set up a consulting group available to members on a fee basis to assist with equipment and process planning and problems. (N) 5. Develop equipment that is more maintenance free or at least relatively simple to maintain. (E)	1. Underwrite equipment or process oriented research. (N) 2. Encourage processors to discuss innovations and processing limits. Become an industry. (N) 3. Convince equipment manufacturers that equipment is needed. (N,I) 4. Encourage industry utilization of new equipment and innovations. (N)	1. Commission a study to examine the effect of depletion allowances on recycling and then recommend modifying tax structure accordingly.

(1) The responsibility for recommended actions shown in this table are based on importance of the action, benefit to the taxpayers, and opportunities for NASMI. They are the best judgments of Battelle.

(2) Recommended actions were distributed between high priority and lower priority based on the evaluation with three criteria.

(3) It is suggested that NASMI continue its leading role in recycling, recognizing that other organizations such as the Bureau of Mines, Department of Commerce, Council of Environmental Quality, HEW Office of Information, and State, Local, and Federal Legislatures must be involved.

The problem concerning lack of know-how about equipment applies to many of the recycling companies to various degrees. It is caused by rapid changes in recycling - higher labor costs, the need for better separation of materials, the trend to larger companies, as well as other factors. The solution calls for education of recycling companies concerning equipment selection, operation, and maintenance.

The problem of equipment availability is based on a lag by equipment manufacturers in making equipment available to serve the needs of recycling. They had overlooked the developing opportunities for major equipment for the recycling industry. In a sense they have rushed their efforts and not offered equipment that suits the industry as well as it could. A solution could be for the recycling industry to approach equipment suppliers as an industry in making needs known.

The problem of depletion and other tax allowances for primary materials is an extremely serious negative incentive for recycling. Because of the seriousness of changes in depletion allowances a thorough study is essential as a basis for possible changes in depletion policies.

Lower Priority Actions

Table 20 presents the ten lower priority general problems of recycling, together with recommended action programs. The first seven of these are recycling industry problems that do not involve governments. They are problems that the industry itself can and should solve.

The first problem, poor image of the recycling industry, has already been greatly reduced by industry publicity activities. It is recommended that such programs be continued and expanded. The second problem, changes in the type of scrap available is more serious than the poor image one. The key element in reducing this problem is for the recycling industry to work more closely with scrap generators.

TABLE 20. RECOMMENDED ACTIONS LOWER PRIORITY GENERAL PROBLEMS

	Poor Image of Recycling Industry	Changes in Types of Scrap Available	Labor Availability
Recommended Action	A strong public relations program to improve the image of the recycling industry.	A continuing recycling industry analysis and forecast.	Improvement of working conditions, adjustment of wages, better image for recycling industry, more effective recruiting, and greater mechanization.
By Whom (1)(2)(3)	NASMI/NASMI Members ISIS/ISIS Members	NASMI/ISIS	NASMI Members
Specific Steps	1. NASMI set guidelines for member company appearances and public relations programs. 2. NASMI investigate new terminology for recycling industry. For example: Old Term Junk, scrap or secondary industry. Scrap, secondary material, etc. New Term Recycling industry Recyclable material Recycled material 3. NASMI and members, expand promotion of the recycling industry tied to environmental improvement theme.	1. NASMI initiate an industry analysis activity. 2. Duties to include: • Forecasts of business conditions. • Forecasts of scrap availability and prices. • Forecasts of markets and prices for recycled materials • (etc.) 3. Publish periodic reports to members: • Annually a 3-5 year outlook • Monthly a 6 months-1 year outlook. 4. NASMI investigate methods for working more closely with scrap sources on information interchange to allow recycle industry to plan better for changes in scrap.	1. Members with labor problems review their own situations objectively to determine reasons for problems. 2. Correct situations insofar as possible--better working conditions, higher pay, etc. 3. Consider using more and better equipment to reduce need for labor and to improve working conditions. 4. Participate in programs to improve the image of the industry. 5. Sell the advantages of the industry to employees and potential employees--steady work, promotion for good workers, etc.

(1) The responsibility for recommended actions shown in this table are based on importance of the action, benefit to the taxpayers, and opportunities for NASMI. They are the best judgments of Battelle.

(2) Recommended actions were distributed between high priority and lower priority based on the evaluation with three criteria.

(3) It is suggested that NASMI continue its leading role in recycling, recognizing that other organizations such as the Bureau of Mines, Department of Commerce, Council of Environmental Quality, HEW Office of Information, and State, Local, and Federal Legislatures must be involved.

TABLE 20. RECOMMENDED ACTIONS LOWER PRIORITY GENERAL PROBLEMS (Continued)

	Management Availability	Rapid Changes in Nature of Recycling Industry	Need for Increased Specialization in Recycling Industry
Recommended Action	Freer and more open attitudes toward outsiders, plus good recruiting programs.	A major educational program for all levels of management.	A continuing recycling industry analysis and forecasts.
By Whom	NASMI Members	NASMI/ISIS	NASMI
Specific Steps	1. Honest and critical self-analysis by members with management problems to determine what changes need to be made to attract and hold high-quality managers and trainees. 2. Make needed changes where possible -- equal opportunities with owner families, bonus plans, etc. 3. Inaugurate new management systems where needed. 4. Participate in programs to improve the image of the industry. 5. Sell the opportunities of the industry to managers and potential managers--free enterprise, rewards based on abilities, contributing to environmental improvement, etc.	1. NASMI organize a committee to: • Study industry changes • Recommend what should be done to prepare companies for changes. 2. Based on recommendations of committee,,develop a program to educate managers of member companies to cope with changes.	1. NASMI organize a committee to analyze needs and opportunities for specialization of operations. 2. Committee recommend further action.

TABLE 20. RECOMMENDED ACTIONS LOWER PRIORITY GENERAL PROBLEMS (Continued)

	Equipment Cost and Financing	Pollution Codes	Discriminatory Classification, Licensing, and Restriction of Scrap Processors	Stockpile Policy
Recommended Action	1. Encourage development of equipment that will do the job for less of a capital outlay. 2. Develop a better industry image as a business. 3. Develop less expensive purchase plans.	1. Coordinate pollution codes at the three levels of government. 2. Investigate ways to reduce the financial burden (to smaller firms) of controlling pollution.	1. Promote the industry and its function as a manufacturer to the general public, government officials, and the industry itself. 2. Encourage enforcement of legislation on a fair basis--not on industry image.	1. Determine the effect of government stockpile policy on recycling and the recycling industry.
By Whom	N - NASMI I - Individual Scrap Processors E - Equipment Manufacturers	NASMI-EPA	NASMI and Individual NASMI Firms	NASMI-EPA
Specific Steps	1. Institute a "used" equipment sales service through NASMI, along with guarantees, etc. (N). 2. Investigate the feasibility of providing financing service in some form to individual firms.(N) 3. Investigate Government sponsored loan programs such as SBA.(N) 4. Set up equipment leasing plans. (N,E) 5. Investigate long-term stable markets or contracts for supplying scrap. Contracts would make firm less of a financial risk. (N,I)	1. Lobby for accelerated depreciation rules to be applied in cases where new equipment is required before old equipment is fully depreciated. 2. Investigate "service policy concept" for pollution control equipment and operation. This transfers the burden to an even payout over time. Becomes an expense rather than a capital expenditure.	1. Encourage firms to not use words like "junk" in their names, listings in yellow pages, etc. 2. Encourage more community participation by scrap processing firms on an official basis. 3. Lobby for effective and fair legislation and enforcement.	1. Commission a study (perhaps in conjunction with depletion allowances) to examine the effect of government stockpile policy on recycling.

The third and fourth problems of labor and management availability are affecting a large part of the recycling industry. The best approach to solving both of these problems is a general improvement in working conditions for labor and management.

The fifth problem, rapid changes in the nature of the recycling industry, is partially a reflection of something good rather than being only a problem. That is the rapid modernization of the recycling industry. The problems of this rapid change could be eased by an expansion of NASMI educational programs to include additional adaptation seminars.

The sixth problem, need for increased specialization in the recycling industry, is related to the rapid change problem. As the industry has grown and changed, opportunities for specialization have grown, and more specialized companies have emerged. An industry self-examination could form the base for increased specialization to improve operations.

The seventh problem, equipment cost and financing, is no problem at all for many recycling companies, but it is for others. An industry program to cover all aspects of the equipment problem could ease the financial burden for some companies and lead to a stronger industry.

The eighth problem, pollution codes, is of different magnitudes in different locations because of variations in codes. It is expected that meeting some codes will be a financial hardship for some smaller companies.

The ninth problem--discriminatory classification, licensing, and restriction of scrap processors--is primarily one of image. States and municipalities sometimes view recycling companies as undesirable businesses. This situation has been improving, and will further improve as their contributions to society are recognized.

The tenth problem, stockpiling policy, affects the recycling industry to an unknown degree. A careful study is necessary to examine the effects and develop sounder policies.

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APPENDIX

EXTENSIVE SURVEY DATA

As a major part of the overall study an extensive survey of the nonferrous secondary materials industry was performed to identify the industry, its capabilities and its problems. The survey involved the following steps:

(1) Sample selection

(2) Questionnaire preparation

(3) Conduct interviews

(4) Tabulation of responses

(5) Analysis of results.

The entire membership of NASMI plus a random sample of nonmember firms formed the basis for the extensive survey sample. Approximately 25 percent of the sample was personally interviewed by an outside research firm while the remaining 75 percent were sent mail questionnaires.

The questionnaire was designed by Battelle in conjunction with NASMI and utilized the expert guidance of NASMI officers and commodity specialists in its preparation. There were 578 valid returned questionnaires which were tabulated and analyzed by the Business Economics Division at Battelle-Columbus.

A sample copy of the questionnaire along with a regional and national tabulation of the results is presented in the following pages.

(130)

CONFIDENTIAL *CONFIDENTIAL*

SECONDARY MATERIALS INDUSTRY CENSUS

(Under NASMI/HEW Solid Waste Utilization Study)

COMPANY NAME ______________________________

STREET ______________________________

CITY ______________ STATE ______________ ZIP ________

PHONE: Area Code ________ NUMBER ______________

RESPONDENT: NAME ______________________

TITLE ______________________

Note: All questions relate to secondary materials only.

A. GENERAL DATA

(1) If your company operates facilities in more than one state, please indicate each state and the approximate percentage of your total business conducted there. (If additional space is needed, please use separate sheet.) [ ] Not Applicable

______________ ____________%

______________ ____________%

______________ ____________%

(2) Please indicate the approximate percent of your total revenue derived from each of the following functions:

	%		%
Nonferrous Scrap Metal Dealer-Processor	____	Importer and Exporter	____
Nonferrous Metal Broker	____	Paper Stock Dealer-Processor Paper Stock Broker	____
Smelter and Refiner	____	Textile Dealer-Processor	____
Ingot Maker	____	Textile Broker	____
Brass Mill	____	Textile Garnetter	____
Scrap Iron Processor and Broker	____	Other (Indicate)	
Sweater	____	______________________	____

Note: Percentages should add to 100%

(3) Total number of all employees including supervisory (secondary materials only).

______________ Employees

(4) Percentage distribution of above employees according to commodity.

	%		%
Aluminum	______	Precious metals	______
Copper and Brass	______	Exotic metals	______
Lead	______	Scrap Iron	______
Zinc	______	Paper	______
Nickel and Nickel Alloys	______	Textiles	______
Stainless Steel	______		

Note: Percentages should add to 100%

(5) Size of all physical plants (secondary materials only).

Yard storage and processing ________ acres

Under roof ________ sq. ft.

(6) Total value of plant and equipment (current market value).

$ ________________

(7) Total 1969 gross sales (secondary materials or products made therefrom only).

☐ Under $1,000,000
☐ 1,000,000 - 3,000,000
☐ 3,000,000 - 5,000,000
☐ 5,000,000 - 8,000,000
☐ 8,000,000 - 12,000,000
☐ 12,000,000 - 20,000,000
☐ 20,000,000 - 30,000,000
☐ 30,000,000 - 50,000,000
☐ Over 50,000,000

COMMODITY DATA - Please answer the following questions on this and the following pages for each commodity applicable to your company in 1969. If not applicable, please indicate so and go on to the next commodity. At the end of the census is a place for registering any additional comments you may have.

Note: Commodities are set forth in this questionnaire as follows:

Metals	*Pages*	*3 - 8*
Paper	*Pages*	*8 - 9*
Textiles	*Pages*	*10 - 12*

METALS

1. **ALUMINUM** ☐ Do not handle aluminum.

(a) Indicate the approximate percentage of total aluminum scrap received from each of the following sources:

Industrial Sources ________%

Collector/Dealer Sources ________%

Over-the-Scale Sources ________%

100%

(b) Indicate total volume of aluminum scrap processed but not melted in 1969.

☐ Under 200 net tons

☐ 200 to 500

☐ 500 to 1,000

☐ 1,000 to 3,000

☐ 3,000 to 5,000

☐ Over 5,000

(c) Indicate volume of aluminum scrap smelted, melted, or otherwise consumed in 1969.

☐ Under 300 net tons

☐ 300 to 1,500

☐ 1,500 to 5,000

☐ 5,000 to 10,000

☐ 10,000 to 20,000

☐ 20,000 to 50,000

☐ Over 50,000

2. COPPER AND BRASS ☐ Do not handle copper or brass.

(a) Indicate the approximate percentage of total copper and brass scrap received from each of the following sources:

Industrial Sources ________%

Collector/Dealer Sources ________%

Over-the-Scale Sources ________%

100%

(b) Indicate total volume of copper and brass scrap processed but not melted in 1969.

☐ Under 200 net tons
☐ 200 to 500
☐ 500 to 1,000
☐ 1,000 to 3,000
☐ 3,000 to 5,000
☐ Over 5,000

(c) Indicate volume of copper and brass scrap smelted, melted or otherwise consumed in 1969.

☐ Under 2,500 net tons
☐ 2,500 to 5,000
☐ 5,000 to 10,000
☐ 10,000 to 20,000
☐ 20,000 to 50,000
☐ Over 50,000

3. LEAD ☐ Do not handle lead.

(a) Indicate the approximate percentage of total lead scrap received from each of the following sources:

Industrial Sources ________%

Collector/Dealer Sources ________%

Over-the-Scale Sources ________%

100%

(b) Indicate total volume of lead scrap processed but not melted in 1969.

☐ Under 100 net tons
☐ 100 to 200
☐ 200 to 1,000
☐ 1,000 to 2,000
☐ 2,000 to 4,000
☐ Over 4,000

(c) Indicate volume of lead scrap smelted, melted, or otherwise consumed in 1969.

☐ Under 1,000 net tons
☐ 1,000 to 2,000
☐ 2,000 to 6,000
☐ 6,000 to 10,000
☐ 10,000 to 20,000
☐ Over 20,000

4. **ZINC** ☐ Do not handle zinc.

(a) Indicate the approximate percentage of total zinc scrap received from each of the following sources:

Industrial Sources ________%
Collector/Dealer Sources ________%
Over-the-Scale Sources ________%
100%

(b) Indicate total volume of zinc scrap processed but not melted in 1969.

☐ Under 50 net tons
☐ 50 to 100
☐ 100 to 500
☐ 500 to 1,000
☐ 1,000 to 2,000
☐ Over 2,000

(c) Indicate volume of zinc scrap smelted, melted, or otherwise consumed in 1969.

☐ Under 500 net tons
☐ 500 to 1,000
☐ 1,000 to 3,000
☐ 3,000 to 5,000
☐ 5,000 to 10,000
☐ Over 10,000

5. NICKEL AND NICKEL ALLOYS (SCRAP GRADES) ☐ Do not handle nickel or nickel alloys

(a) Indicate the approximate percentage of total nickel and nickel alloy grades of scrap (not including stainless steel grades) received from each of the following sources:

Industrial Sources ________%

Collector/Dealer Sources ________%

Over-the-Scale Sources ________%

100%

(b) Indicate total volume of nickel and nickel alloy grade scrap (not including stainless steel grades) processed in 1969.

☐ Under 20 tons
☐ 20 to 100
☐ 100 to 300
☐ 300 to 500
☐ 500 to 1,000
☐ Over 1,000

6. STAINLESS STEEL (SCRAP GRADES) ☐ Do not handle stainless steel.

(a) Indicate the approximate percentage of total stainless steel scrap received from each of the following sources:

Industrial Sources ________%

Collector/Dealer Sources ________%

Over-the-Scale Sources. ________%

100%

(b) Indicate total volume of stainless steel scrap processed in 1969.

☐ Under 200 net tons
☐ 200 to 1,000
☐ 1,000 to 3,000
☐ 3,000 to 5,000
☐ 5,000 to 10,000
☐ Over 10,000

7. PRECIOUS METALS (SUCH AS SILVER, GOLD, PLATINUM, PALLADIUM, ETC.)

☐ Do not handle precious metals.

(a) Indicate the approximate percentage of total precious metals scrap received from each of the following sources:

Industrial Sources ________%

Collector/Dealer Sources ________%

Over-the-Scale Sources ________%

________ 100%

(b) Indicate total volume of precious metals-bearing materials processed but not refined in 1969.

(1) Gross material weight

☐ Under 2 net tons

☐ 2 to 5

☐ 5 to 10

☐ 10 to 15

☐ 15 to 20

☐ Over 20

(2) Solutions

☐ Under 100 gallons

☐ 100 to 1,000

☐ 1,000 to 5,000

☐ 5,000 to 10,000

☐ Over 10,000

(c) Indicate volume of precious metal content refined from scrap.

Gold	Silver	Platinum Metals	
☐	☐	☐	Under 500 troy oz.
☐	☐	☐	500 to 1,000
☐	☐	☐	1,000 to 2,000
☐	☐	☐	2,000 to 5,000
☐	☐	☐	5,000 to 25,000
☐	☐	☐	Over 25,000

8. EXOTIC METALS (SUCH AS MOLYBDENUM, TITANIUM, TUNGSTEN, ETC.)

☐ Do not handle exotic metals.

(a) Indicate the approximate percentage of total exotic metals scrap received from each of the following sources:

Industrial Sources ________%
Collector/Dealer Sources ________%
Over-the-Scale Sources ________%
100%

(b) Indicate total volume of exotic metals scrap processed in 1969.

☐ Under 5 net tons
☐ 5 to 10
☐ 10 to 25
☐ 25 to 50
☐ 50 to 100
☐ Over 100

PAPER

9. PAPER

☐ Do not handle paper.

(a) Indicate the approximate percentage of waste paper your company purchased from each of the following sources in 1969 (whether or not the paper was physically handled through your plant or plants):

(1) Industrial and commercial sources
- Manufacturing, converting, and printing plants, etc. ________%
- Office buildings ________%
- Supermarkets, Department stores, and other retail outlets ________%

(2) Collector/dealer sources ________%

(3) Over-the-scale sources (including Institutions where applicable) ________%

(4) Other (please identify) ____________________ ________%

100%

(b) Estimate the percentage of the above waste paper that came from the following:

(1) Organizational and institutional sources including paper drives _______%

(2) Municipal waste _______%

(c) The total tonnage of waste paper and paperstock you purchased in 1969 (including paper handled on brokerage or agent basis--whether or not it physically moved through your plant or plants):

☐ 0 - 25,000 net tons
☐ 25,000 - 50,000
☐ 50,000 - 75,000
☐ 75,000 - 100,000
☐ 100,000 - 125,000
☐ 125,000 - 150,000
☐ 150,000 - 175,000
☐ 175,000 - 200,000
☐ 200,000 and over

(d) What percentage of the total tonnage indicated in question (c) did you physically handle through your plant or plants in 1969:

_______%

(e) The maximum tonnage of paperstock you could have physically handled through your plant in 1969 with the facilities you had at that time:

☐ 0 - 6,000 net tons
☐ 6,000 - 10,000
☐ 10,000 - 15,000
☐ 15,000 - 20,000
☐ 20,000 - 25,000
☐ 25,000 - 35,000
☐ 35,000 - 50,000
☐ Over 50,000

(f) On the average, how many hours per week did your plant operate in 1969?

_______ Hours

TEXTILES

10. **TEXTILES**

☐ Do not handle textiles, mill cuttings, and/or rags.

(a) Indicate the approximate percentage of mill cuttings and/or rags of all types received from each of the following sources:

Industrial Sources	______%
Collector/Dealer Sources	______%
Organizational and Institutional Sources	______%
	100%

(b) What percentage of the total tonnage indicated above did you physically handle through your plant or plants in 1969:

______%

(c) Indicate total volume of all cotton cuttings and/or rags processed in 1969.

☐ Under 5,000,000 pounds

☐ 5,000,000 - 10,000,000

☐ 10,000,000 - 25,000,000

☐ Over 25,000,000

(d) Indicate what percentage of above volume was:

New Material	______%
Old Material	______%
	100%

(e) Indicate total volume of all wool rag cuttings and/or rags processed in 1969.

☐ Under 5,000,000 pounds

☐ 5,000,000 - 10,000,000

☐ 10,000,000 - 25,000,000

☐ Over 25,000,000

(f) Indicate what percentage of above volume was:

New Material ________%

Old Material ________%

100%

(g) Indicate total volume of all synthetic cuttings and/or rags processed in 1969.

☐ Under 5,000,000 pounds

☐ 5,000,000 - 10,000,000

☐ 10,000,000 - 25,000,000

☐ Over 25,000,000

(h) Indicate what percentage of above volume was:

New Material ________%

Old Material ________%

100%

(i) Indicate total volume of synthetic blended cuttings and/or rags with cotton, wool, etc.

☐ Under 5,000,000 pounds

☐ 5,000,000 - 10,000,000

☐ 10,000,000 - 25,000,000

☐ Over 25,000,000

(j) Indicate what percentage of above volume was:

New Material ________%

Old Material ________%

100%

We would be interested in any additional comments you may wish to make. Use separate sheet if more space is required.

IN-DEPTH SURVEY

Interview Guide - Sources

Classification Data: Company name, company size, major locations, number of employees

Discuss Industry Flow Chart

Scrap Practices

- How disposed of?--Why?
- Types, quantity, grades, forms?
- Percent of material by end use that is recycled
- What types of scrap are generated but not recycled?
- Changes from 5 years ago? Why?
- Future changes? Why?

Changes and Trends: Are there any readily discernable changes and trends related to:

- Basis for decision to dispose of waste vs sorting and sale - policy changes?
- Markets
- In-house recycling
- Price vs cost of segregation
- Type of scrap generated
- Sale vs outright disposal
- Handling of scrap
- Source of scrap
- Quality control
- Required investment in equipment, etc.
- Extent of segregation for processor/broker/dealer

(143)

Problems: What problems do you have related to:

- Markets
- Prices
- Handling/segregation
- Storage
- Transportation
- Pollution control
- Government actions
- Zoning
- Export/import
- Others

What efforts have been made to overcome any of the above problems? Results?

Actions Needed: Actions needed to increase solid waste utilization or help to alleviate any of the above problems

- By buyers
- By yourself or yourselves
- By raw material suppliers
- By secondary materials users
- By governments
- By others - who?

Other Comments

- Changes in technology which would increase or decrease current scrap supply

IN-DEPTH SURVEY

Interview Guide - Processors/Brokers/Dealers

Classification Data: Company name, company size, major locations, number of employees

Discuss Industry Flow Chart

Current Operations

- Degree of materials specialization
- Degree of automation
- Major types of customers - why?
- Major types of potential customers - why?
- Major sources of scrap - why?
- Major potential sources of scrap - why?
- Geographical area covered - supply; markets
- How operations differ from 5 years ago - why?
- Critical factors in success of your business?
- Fluctuations in scrap availability - why? Effects?
- Fluctuations in scrap demand - why? Effects?
- Ease of capacity changes?
- Ease of entry into the industry? Factors to be considered?
- What determines your operating level?
- Percentage distribution of costs; materials, labor, other?
- Import/export
- What scrap sources are not used and why?

Changes and Trends: Are there any readily discernible changes and trends related to:

- Primary vs. scrap sources

- Types and grades of materials
- Quantities of scrap supplies
- Quality of available scrap
- Prices
- Processing innovations (automation)
- Costs
- Capacity
- Size of markets
- Integration in supply, processing, and use - captive operations - in-house capabilities
- Innovations in the collection, transportation, or sale of scrap

Problems: What problems do you have related to:

- Materials availability
- Materials properties
- Markets
- Government actions
- Waste disposal
- Materials handling and processing
- Space
- Transportation
- Pollution control
- Labor
- Export/import
- Equipment
- What efforts have been made to overcome any of the above problems? Results?

Suggested Actions: Do you have any ideas or suggested actions that might help to increase solid waste utilization or help to alleviate any of the above problems?

- By scrap generators or supplies
- By scrap processors
- By scrap users
- By governments
- By NASMI
- By others - who?

Other Comments

- Who to see

IN-DEPTH SURVEY

Interview Guide - Users

Classification Data: Company name, company size, major locations, number of employees

Discuss Industry Flow Chart

Use of Secondary Material

- Do you use? Why? End use?
- Volume changes from 5 years ago? Why?
- Future volume changes? Why?
- Degree of integration with source of both primary and secondary
- Sources?
- Types, grades, forms?
- Percent secondary? What determines percent? How variable?
- Informal ties with sources - importance of?

Changes and Trends: Are there any readily discernible changes and trends related to

- Possibility of using lower quality secondary materials - what would be needed?
- Price of secondary vs primary material
- Availability
- Quality
- Domestic vs foreign sources
- Requirements calling for use of only primary materials
- Bias against/for use of secondary

Problems: What problems (cyclical or constant) do you have related to

- Availability
- Quality
- Costs
- Process constraints
- Transportation
- Material storage
- Processing
- Others

Actions Needed: Actions needed to increase the utilization of secondary materials or to help alleviate any of the above problems

- By suppliers
- By yourself
- By governments
- By others - Who?

Other Comments

- Changes in technology which would increase/decrease the need for secondary materials

Analysis of Extensive Survey Responses

The extensive survey yielded information which was analyzed and tabulated in the following way:

(a) Type of operation

(b) Region of operation

(c) Commodity

(d) Business statistics.

In addition to the tabulations listed above, the extensive survey provided data and information that is used throughout the various commodity reports as well as the General Report in this volume.

No effort has been made relative to the tables that follow to analyze the tabulations and cross tabulations from a cause and effect standpoint. The relationships have not been tested for statistical significance and indeed further analysis of these relationships or other relationships that could be constructed is considered outside the scope of this study. Thus, the following tables are presented, without comment and for information only. Throughout the various commodity reports, however, charts and graphs have been prepared and do form an integral part of the specific subject.

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UNKNOWN	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST NORTH CENTRAL	EAST SOUTH CENTRAL	WEST NORTH CENTRAL	WEST SOUTH CENTRAL	MOUNTAIN	PACIFIC	OUTSID UNITED STATE
TOTAL COUNT	578	45	45	171	50	152	19	24	18	17	81	1
REGION BUSINESS CONDUCTED	578	45	45	171	50	152	19	24	18	17	81	1
UNKNOWN	0	0	0	0	0	0	0	0	0	0	0	0
NEW ENGLAND	45	45	45	0	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC	171	0	0	171	0	0	0	0	0	0	0	0
SOUTH ATLANTIC	50	0	0	0	50	0	0	0	0	0	0	0
EAST NORTH ATLANTIC	152	0	0	0	0	152	0	0	0	0	0	0
EAST SOUTH CENTRAL	19	0	0	0	0	0	19	0	0	0	0	0
WEST NORTH CENTRAL	24	0	0	0	0	0	0	24	0	0	0	0
WEST SOUTH CENTRAL	18	0	0	0	0	0	0	0	18	0	0	0
MOUNTAIN	17	0	0	0	0	0	0	0	0	17	0	0
PACIFIC	81	0	0	0	0	0	0	0	0	0	81	0
OUTSIDE UNITED STATES	1	0	0	0	0	0	0	0	0	0	0	1
BUSINESS IN UNKNOWN	3	0	0	1	0	0	1	0	0	0	1	0
1 TO 25 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
26 TO 50 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	3	0	0	1	0	0	1	0	0	0	1	0
BUSINESS IN NEW ENGLAND	17	6	6	8	2	1	0	0	0	0	0	0
1 TO 25 PERCENT	8	0	0	5	2	1	0	0	0	0	0	0
26 TO 50 PERCENT	1	0	0	1	0	0	0	0	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	8	6	6	2	0	0	0	0	0	0	0	0
BUSINESS MIDDLE ATLANTIC	40	0	0	34	2	4	0	0	0	0	0	0
1 TO 25 PERCENT	6	0	0	2	1	3	0	0	0	0	0	0
26 TO 50 PERCENT	8	0	0	6	1	1	0	0	0	0	0	0
51 TO 75 PERCENT	6	0	0	6	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	20	0	0	20	0	0	0	0	0	0	0	0
BUSINESS SOUTH ATLANTIC	20	0	0	7	9	1	1	1	1	0	0	0
1 TO 25 PERCENT	6	0	0	3	0	0	1	1	1	0	0	0
26 TO 50 PERCENT	6	0	0	4	1	1	0	0	0	0	0	0
51 TO 75 PERCENT	2	0	0	0	2	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	6	0	0	0	6	0	0	0	0	0	0	0
BUSINESS EAST NORTH ATLANTIC	37	0	0	8	0	24	0	4	1	0	0	0
1 TO 25 PERCENT	13	0	0	8	0	1	0	3	1	0	0	0
26 TO 50 PERCENT	1	0	0	0	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	5	0	0	0	0	4	0	1	0	0	0	0
MORE THAN 75 PERCENT	18	0	0	0	0	18	0	0	0	0	0	0
BUSINESS EAST SOUTH CENTRAL	11	0	0	0	3	4	1	1	2	0	0	0
1 TO 25 PERCENT	6	0	0	0	1	4	0	0	1	0	0	0
26 TO 50 PERCENT	3	0	0	0	1	0	0	1	1	0	0	0
51 TO 75 PERCENT	2	0	0	0	1	0	1	0	0	0	0	0
MORE THAN 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
BUSINESS WEST NORTH CENTRAL	10	0	0	1	0	1	0	6	1	1	0	0
1 TO 25 PERCENT	2	0	0	0	0	0	0	0	1	1	0	0
26 TO 50 PERCENT	2	0	0	1	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	1	0	0	0	0	0	0	1	0	0	0	0
MORE THAN 75 PERCENT	5	0	0	0	0	0	0	5	0	0	0	0
BUSINESS WEST SOUTH CENTRAL	11	0	0	3	0	0	0	1	5	2	0	0
1 TO 25 PERCENT	4	0	0	2	0	0	0	1	0	1	0	0

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN-KNOWN	NEW ENG-LAND	MID-DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN-TRAL	EAST SOUTH CEN-TRAL	WEST NORTH CEN-TRAL	WEST SOUTH CEN-TRAL	MOUN-TAIN	PAC-IFIC	OUTSID UNI-TED STATE
26 TO 50 PERCENT	2	0	0	0	0	0	0	0	1	1	0	0
51 TO 75 PERCENT	2	0	0	1	0	0	0	0	1	0	0	0
MORE THAN 75 PERCENT	3	0	0	0	0	0	0	0	3	0	0	0
BUSINESS MOUNTAIN	9	0	0	3	0	0	0	1	1	2	2	0
1 TO 25 PERCENT	6	0	0	2	0	0	0	1	1	0	2	0
26 TO 50 PERCENT	1	0	0	0	0	0	0	0	0	1	0	0
51 TO 75 PERCENT	1	0	0	1	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	1	0	0	0	0	0	0	0	0	1	0	0
BUSINESS IN PACIFIC	21	0	0	7	1	3	0	1	1	0	8	0
1 TO 25 PERCENT	9	0	0	4	1	3	0	1	0	0	0	0
26 TO 50 PERCENT	4	0	0	3	0	0	0	0	1	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	8	0	0	0	0	0	0	0	0	0	8	0
BUSINESS OUTSIDE US	4	1	1	2	1	0	0	0	0	0	0	0
1 TO 25 PERCENT	2	0	0	1	1	0	0	0	0	0	0	0
26 TO 50 PERCENT	2	1	1	1	0	0	0	0	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
NFERROUS METAL DEALER-PROCESOR	334	28	28	90	30	85	10	11	13	13	53	1
1 TO 25 PERCENT OF REVENUE	75	2	2	20	9	26	4	2	1	0	11	0
26 TO 50 PERCENT OF REVENUE	74	6	6	19	10	19	2	2	7	2	7	0
51 TO 75 PERCENT OF REVENUE	66	7	7	12	6	14	3	4	4	5	11	0
MORE THAN 75 PERCENT REVENUE	119	13	13	39	5	26	1	3	1	6	24	1
NFERROUS METAL BROKER	169	17	17	50	11	49	7	5	5	6	18	1
1 TO 25 PERCENT OF REVENUE	125	12	12	32	9	41	5	4	3	6	12	1
26 TO 50 PERCENT OF REVENUE	24	3	3	11	1	4	1	0	2	0	2	0
51 TO 75 PERCENT OF REVENUE	7	0	0	3	1	2	0	0	0	0	1	0
MORE THAN 75 PERCENT REVENUE	13	2	2	4	0	2	1	1	0	0	3	0
SMELTER AND REFINER	126	8	8	35	10	43	4	4	3	4	15	0
1 TO 25 PERCENT OF REVENUE	36	5	5	8	3	13	1	1	0	2	3	0
26 TO 50 PERCENT OF REVENUE	15	2	2	5	3	3	1	0	1	0	0	0
51 TO 75 PERCENT OF REVENUE	12	0	0	2	1	6	0	0	0	1	2	0
MORE THAN 75 PERCENT REVENUE	63	1	1	20	3	21	2	3	2	1	10	0
INGOT MAKER	43	4	4	7	3	18	1	2	0	3	5	0
1 TO 25 PERCENT OF REVENUE	17	2	2	2	2	4	0	1	0	2	4	0
26 TO 50 PERCENT OF REVENUE	4	0	0	2	0	1	0	0	0	1	0	0
51 TO 75 PERCENT OF REVENUE	6	0	0	1	0	3	1	0	0	0	1	0
MORE THAN 75 PERCENT REVENUE	16	2	2	2	1	10	0	1	0	0	0	0
BRASS MILL	31	6	6	5	1	12	0	4	0	0	3	0
1 TO 25 PERCENT OF REVENUE	22	4	4	5	0	7	0	3	0	0	3	0
26 TO 50 PERCENT OF REVENUE	6	2	2	0	0	4	0	0	0	0	0	0
51 TO 75 PERCENT OF REVENUE	2	0	0	0	1	0	0	1	0	0	0	0
MORE THAN 75 PERCENT REVENUE	1	0	0	0	0	1	0	0	0	0	0	0
SCRAP IRON PROCESR AND BROKER	165	18	18	28	19	38	7	8	9	7	31	0
1 TO 25 PERCENT OF REVENUE	73	8	8	19	5	12	2	5	1	4	17	0
26 TO 50 PERCENT OF REVENUE	57	8	8	5	8	12	3	3	8	2	8	0
51 TO 75 PERCENT OF REVENUE	27	2	2	1	6	11	1	0	0	1	5	0
MORE THAN 75 PERCENT REVENUE	8	0	0	3	0	3	1	0	0	0	1	0
SWEATER	56	3	3	7	9	15	1	2	6	2	11	0
1 TO 25 PERCENT OF REVENUE	54	3	3	7	8	15	1	2	6	2	10	0

SECONDARY MATERIALS INDUSTRY CENSUS 04/21/71

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN- KNOWN	NEW ENG- LAND	MID- DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN- TRAL	EAST SOUTH CEN- TRAL	WEST NORTH CEN- TRAL	WEST SOUTH CEN- TRAL	MOUN- TAIN	PAC- IFIC	OUTSID UNI- TED STATE
26 TO 50 PERCENT OF REVENUE	2	0	0	0	1	0	0	0	0	0	1	0
51 TO 75 PERCENT OF REVENUE	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT REVENUE	0	0	0	0	0	0	0	0	0	0	0	0
IMPORTER AND EXPORTER	101	6	6	45	10	14	1	4	2	2	17	0
1 TO 25 PERCENT OF REVENUE	71	4	4	27	7	12	0	4	2	2	13	0
26 TO 50 PERCENT OF REVENUE	11	1	1	3	3	1	1	0	0	0	2	0
51 TO 75 PERCENT OF REVENUE	7	1	1	4	0	0	0	0	0	0	2	0
MORE THAN 75 PERCENT REVENUE	12	0	0	11	0	1	0	0	0	0	0	0
PAPER STOCK DEALR-PROCSR	89	8	8	19	9	29	4	5	4	1	10	0
1 TO 25 PERCENT OF REVENUE	28	3	3	7	2	12	1	2	0	0	1	0
26 TO 50 PERCENT OF REVENUE	26	1	1	7	2	12	0	0	1	0	3	0
51 TO 75 PERCENT OF REVENUE	13	1	1	3	4	0	1	1	1	0	2	0
MORE THAN 75 PERCENT REVENUE	22	3	3	2	1	5	2	2	2	1	4	0
PAPER STOCK BROKER	81	7	7	21	6	28	3	5	1	1	9	0
1 TO 25 PERCENT OF REVENUE	35	3	3	8	4	8	3	4	1	0	4	0
26 TO 50 PERCENT OF REVENUE	14	1	1	5	2	4	0	1	0	0	1	0
51 TO 75 PERCENT OF REVENUE	14	1	1	2	0	8	0	0	0	1	2	0
MORE THAN 75 PERCENT REVENUE	18	2	2	6	0	8	0	0	0	0	2	0
TEXTILE DEALER-PROCESSOR	48	1	1	14	9	10	2	5	2	1	4	0
1 TO 25 PERCENT OF REVENUE	18	1	1	4	2	5	0	2	0	1	3	0
26 TO 50 PERCENT OF REVENUE	6	0	0	2	0	2	0	0	2	0	0	0
51 TO 75 PERCENT OF REVENUE	10	0	0	3	5	1	1	0	0	0	0	0
MORE THAN 75 PERCENT REVENUE	14	0	0	5	2	2	1	3	0	0	1	0
TEXTILE BROKER	23	1	1	8	6	4	1	2	0	1	0	0
1 TO 25 PERCENT OF REVENUE	17	0	0	5	4	4	1	2	0	1	0	0
26 TO 50 PERCENT OF REVENUE	5	1	1	2	2	0	0	0	0	0	0	0
51 TO 75 PERCENT OF REVENUE	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT REVENUE	1	0	0	1	0	0	0	0	0	0	0	0
TEXTILE GARNETTER	8	0	0	4	1	2	0	1	0	0	0	0
1 TO 25 PERCENT OF REVENUE	4	0	0	1	1	2	0	0	0	0	0	0
26 TO 50 PERCENT OF REVENUE	2	0	0	2	0	0	0	0	0	0	0	0
51 TO 75 PERCENT OF REVENUE	1	0	0	0	0	0	0	1	0	0	0	0
MORE THAN 75 PERCENT REVENUE	1	0	0	1	0	0	0	0	0	0	0	0
OTHER FUNCTION	46	0	0	9	5	16	1	2	1	2	10	0
1 TO 25 PERCENT OF REVENUE	26	0	0	1	3	9	1	1	1	2	8	0
26 TO 50 PERCENT OF REVENUE	9	0	0	2	1	5	0	1	0	0	0	0
51 TO 75 PERCENT OF REVENUE	1	0	0	0	0	1	0	0	0	0	0	0
MORE THAN 75 PERCENT REVENUE	10	0	0	6	1	1	0	0	0	0	2	0
TOTAL NUMBER OF EMPLOYEES	554	44	44	156	49	149	19	23	18	16	79	1
0 TO 25	258	29	29	81	9	62	5	9	3	9	50	1
26 TO 50	119	12	12	26	18	32	6	4	4	4	13	0
51 TO 100	88	1	1	19	14	26	5	7	8	1	7	0
101 TO 150	37	1	1	6	5	12	2	2	2	1	6	0
MORE THAN 150	52	1	1	24	3	17	1	1	1	1	3	0
ALUMINUM	312	24	24	76	28	85	13	12	12	10	51	1
1 TO 25 PERCENT OF EMPLOYEES	171	14	14	48	19	44	6	6	8	4	21	1
26 TO 50 PERCENT OF EMPLYES	55	8	8	7	3	15	3	0	4	4	11	0
51 TO 75 PERCENT OF EMPLYES	22	0	0	3	1	6	1	2	0	1	8	0
MORE THAN 75 PERCENT EMPLYES	64	2	2	18	5	20	3	4	0	1	11	0
COPPER AND BRASS	266	24	24	79	21	67	7	9	10	8	40	1

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ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN- KNOWN	NEW ENG- LAND	MID- DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN- TRAL	EAST SOUTH CEN- TRAL	WEST NORTH CEN- TRAL	WEST SOUTH CEN- TRAL	MOUN- TAIN	PAC- IFIC	OUTSID UNI- TED STATE
1 TO 25 PERCENT OF EMPLOYEES	118	8	8	27	12	31	4	6	7	4	19	0
26 TO 50 PERCENT OF EMPLYES	62	11	11	15	4	12	2	1	3	3	11	0
51 TO 75 PERCENT OF EMPLYES	42	4	4	18	4	10	0	0	0	0	5	1
MORE THAN 75 PERCENT EMPLYES	44	1	1	19	1	14	1	2	0	1	5	0
LEAD	199	20	20	54	18	50	5	7	10	6	29	1
1 TO 25 PERCENT OF EMPLOYEES	173	19	19	46	15	41	4	7	9	6	25	1
26 TO 50 PERCENT OF EMPLYES	7	0	0	3	0	2	1	0	0	0	1	0
51 TO 75 PERCENT OF EMPLYES	3	0	0	0	1	2	0	0	0	0	0	0
MORE THAN 75 PERCENT EMPLYES	16	1	1	5	2	5	0	0	1	0	2	0
ZINC	167	17	17	41	12	46	6	6	8	5	25	1
1 TO 25 PERCENT OF EMPLOYEES	148	17	17	36	12	36	5	6	7	5	23	1
26 TO 50 PERCENT OF EMPLYES	8	0	0	1	0	5	1	0	1	0	0	0
51 TO 75 PERCENT OF EMPLYES	3	0	0	0	0	2	0	0	0	0	1	0
MORE THAN 75 PERCENT EMPLYES	8	0	0	4	0	3	0	0	0	0	1	0
NICKEL AND NICKEL ALLOYS	179	21	21	52	11	43	4	7	7	3	31	0
1 TO 25 PERCENT OF EMPLOYEES	155	21	21	41	11	36	4	5	7	3	27	0
26 TO 50 PERCENT OF EMPLYES	13	0	0	4	0	5	0	1	0	0	3	0
51 TO 75 PERCENT OF EMPLYES	6	0	0	2	0	2	0	1	0	0	1	0
MORE THAN 75 PERCENT EMPLYES	5	0	0	5	0	0	0	0	0	0	0	0
STAINLESS STEEL	185	18	18	47	17	46	5	6	9	4	32	1
1 TO 25 PERCENT OF EMPLOYEES	176	18	18	43	16	44	5	5	9	4	31	1
26 TO 50 PERCENT OF EMPLYES	6	0	0	2	0	2	0	1	0	0	1	0
51 TO 75 PERCENT OF EMPLYES	2	0	0	1	1	0	0	0	0	0	0	0
MORE THAN 75 PERCENT EMPLYES	1	0	0	1	0	0	0	0	0	0	0	0
PRECIOUS METALS	75	6	6	35	2	10	0	1	2	2	17	0
1 TO 25 PERCENT OF EMPLOYEES	60	6	6	25	2	9	0	1	1	2	14	0
26 TO 50 PERCENT OF EMPLYES	3	0	0	1	0	0	0	0	1	0	1	0
51 TO 75 PERCENT OF EMPLYES	1	0	0	1	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT EMPLYES	11	0	0	8	0	1	0	0	0	0	2	0
EXOTIC METALS	65	5	5	26	5	15	0	1	2	1	10	0
1 TO 25 PERCENT OF EMPLOYEES	57	5	5	24	4	11	0	1	2	1	9	0
26 TO 50 PERCENT OF EMPLYES	3	0	0	1	0	1	0	0	0	0	1	0
51 TO 75 PERCENT OF EMPLYES	2	0	0	0	1	1	0	0	0	0	0	0
MORE THAN 75 PERCENT EMPLYES	3	0	0	1	0	2	0	0	0	0	0	0
SCRAP METALS	159	15	15	27	20	39	8	6	10	5	29	0
1 TO 25 PERCENT OF EMPLOYEES	62	8	8	14	6	11	2	4	1	2	14	0
26 TO 50 PERCENT OF EMPLYES	45	5	5	8	6	13	2	1	4	1	5	0
51 TO 75 PERCENT OF EMPLYES	32	1	1	1	6	9	2	0	4	2	7	0
MORE THAN 75 PERCENT EMPLYES	19	1	1	4	2	6	2	1	1	0	2	0
PAPER	103	10	10	22	11	34	5	5	4	1	11	0
1 TO 25 PERCENT OF EMPLOYEES	17	2	2	3	3	6	2	1	0	0	0	0
26 TO 50 PERCENT OF EMPLYES	11	1	1	3	1	4	0	0	2	0	0	0
51 TO 75 PERCENT OF EMPLYES	8	0	0	2	3	2	0	1	0	0	0	0
MORE THAN 75 PERCENT EMPLYES	67	7	7	14	4	22	3	3	2	1	11	0
TEXTILES	54	2	2	20	9	10	2	4	2	2	3	0
1 TO 25 PERCENT OF EMPLOYEES	11	1	1	5	1	3	0	0	0	0	1	0
26 TO 50 PERCENT OF EMPLYES	11	1	1	2	2	2	0	1	2	1	0	0
51 TO 75 PERCENT OF EMPLYES	1	0	0	0	0	1	0	0	0	0	0	0
MORE THAN 75 PERCENT EMPLYES	31	0	0	13	6	4	2	3	0	1	2	0
AREA OF OUTDOOR STORAGE+PROC	578	45	45	171	59	152	19	24	18	17	81	1

SECONDARY MATERIALS INDUSTRY CENSUS 04/21/71

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN-KNOWN	NEW ENG-LAND	MID-DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN-TRAL	EAST SOUTH CEN-TRAL	WEST NORTH CEN-TRAL	WEST SOUTH CEN-TRAL	MOUN-TAIN	PAC-IFIC	OUTSID UNI-TED STATE
AREA UNKNOWN	184	12	12	83	14	38	2	8	1	3	23	0
1 ACRE	52	4	4	14	3	10	2	2	2	2	13	0
2 ACRES	62	8	8	10	5	17	2	2	1	4	13	0
3 TO 5 ACRES	99	7	7	24	9	32	2	4	4	0	17	0
6 TO 10	66	5	5	17	8	20	4	2	4	3	2	1
11 TO 15	39	5	5	6	2	12	1	3	3	3	4	0
MORE THAN 15	76	4	4	17	9	23	6	3	3	2	9	0
AREA UNDER ROOF	578	45	45	171	50	152	19	24	18	17	81	1
UNKNOWN AREA	83	5	5	49	1	13	2	2	0	0	11	0
LESS THAN 5000 SQUARE FEET	54	3	3	10	7	11	1	1	1	3	16	1
5001 TO 10,000 SQ.FEET	69	5	5	15	2	19	1	4	1	3	18	1
10,001 TO 25,000 SQ.FEET	138	15	15	35	11	32	7	2	9	5	22	0
25,001 TO 50,000 SQ.FEET	95	10	10	24	10	26	4	5	3	4	9	0
MORE THAN 50,000 SQ.FEET	153	8	8	42	20	53	4	11	5	2	8	0
TOTAL VALUE OF PLANT+EQUIPMENT	417	34	34	99	41	113	12	21	16	15	65	1
LESS THAN $250,000	114	12	12	24	9	32	1	4	1	5	25	1
$250,000 TO $500,000	103	11	11	20	13	23	6	6	5	4	15	0
$501,000 TO $1 MILLION	77	8	8	19	7	18	1	4	7	2	11	0
$1,001,000 TO $2 MILLION	58	1	1	14	7	18	3	5	2	2	6	0
$2,001,000 TO $7 MILLION	47	0	0	17	5	14	0	2	1	2	6	0
$7,001,000 TO $10 MILLION	7	1	1	1	0	3	0	0	0	0	2	0
OVER $10 MILLION	11	1	1	4	0	5	1	0	0	0	0	0
TOTAL 1969 GROSS SALES	533	40	40	152	46	143	18	22	17	16	78	1
UNDER $1,000,000	93	8	8	19	6	21	5	5	3	4	22	0
1,000,000 TO 3,000,000	165	15	15	35	16	53	5	7	3	7	23	1
3,000,000 TO 5,000,000	93	7	7	35	12	17	2	4	4	2	10	0
5,000,000 TO 8,000,000	61	3	3	16	5	17	5	1	3	1	10	0
8,000,000 TO 12,000,000	37	3	3	13	2	9	0	2	0	1	7	0
12,000,000 TO 20,000,000	39	3	3	14	3	12	0	1	1	0	5	0
20,000,000 TO 30,000,000	12	1	1	3	1	2	1	1	2	0	1	0
30,000,000 TO 50,000,000	20	0	0	10	1	8	0	0	0	1	0	0
OVER 50,000,000	13	0	0	7	0	4	0	1	1	0	0	0
HANDLES ALUMINUM	393	33	33	93	37	100	16	19	12	15	62	1
SCRAP RECEVD INDSTRAL SOURCES	291	24	24	65	26	81	10	15	11	13	45	1
1 TO 25 PERCENT	96	5	5	23	9	30	2	3	6	1	17	0
26 TO 50 PERCENT	58	5	5	13	7	15	0	2	3	4	9	0
51 TO 75 PERCENT	51	4	4	9	4	14	2	3	2	4	8	1
MORE THAN 75 PERCENT	86	10	10	20	6	22	6	7	0	4	11	0
COLLECTOR/DEALER SOURCES	269	20	20	62	24	74	10	14	10	10	44	1
1 TO 25 PERCENT	87	9	9	16	7	20	5	6	2	5	16	1
26 TO 50 PERCENT	73	5	5	14	9	19	2	3	2	4	15	0
51 TO 75 PERCENT	38	4	4	13	3	11	0	0	4	0	3	0
MORE THAN 75 PERCENT	71	2	2	19	5	24	3	5	2	1	10	0
OVER-THE-SCALE SOURCE	189	16	16	35	19	46	4	7	11	10	40	1
1 TO 25 PERCENT	124	10	10	21	11	35	3	6	9	8	20	1
26 TO 50 PERCENT	30	5	5	3	4	6	1	1	0	2	8	0
51 TO 75 PERCENT	14	0	0	6	2	2	0	0	0	0	4	0
MORE THAN 75 PERCENT	21	1	1	5	2	3	0	0	2	0	8	0
VOLUME PROCSD NOT MELTED	310	26	26	67	29	81	11	14	12	13	56	1
UNDER 200 NET TONS	94	6	6	22	6	28	4	3	2	6	17	0

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN-KNOWN	NEW ENG-LAND	MID-DLE ATLAN-TIC	SOUTH ATLAN-TIC	EAST NORTH CEN-TRAL	EAST SOUTH CEN-TRAL	WEST NORTH CEN-TRAL	WEST SOUTH CEN-TRAL	MOUN-TAIN	PAC-IFIC	OUTSID UNI-TED STATE
200 TO 500	71	6	6	15	9	17	2	6	2	2	12	0
500 TO 1,000	54	5	5	8	8	21	1	0	2	1	7	1
1,000 TO 3,000	50	6	6	13	4	8	2	2	4	2	9	0
3,000 TO 5,000	20	3	3	1	1	4	1	3	1	0	6	0
OVER 5,000	21	0	0	8	1	3	1	0	1	2	5	0
VOLUME SMELTD,MELTD,OTHER	166	6	6	36	13	51	6	10	9	7	28	0
UNDER 300 NET TONS	84	6	6	21	4	25	2	5	3	6	12	0
300 TO 1,500	29	0	0	4	3	6	1	1	5	0	9	0
1,500 TO 5,000	17	0	0	1	3	4	2	1	1	0	5	0
5,000 TO 10,000	9	0	0	3	2	2	0	0	0	0	2	0
10,000 TO 20,000	14	0	0	4	0	8	0	2	0	0	0	0
20,000 TO 50,000	6	0	0	2	1	2	1	0	0	0	0	0
OVER 50,000	7	0	0	1	0	4	0	1	0	1	0	0
HANDLES COPPER OR BRASS	411	35	35	124	35	100	14	16	13	14	59	1
SCRAP RECEVD INDSTRAL SOURCES	286	24	24	74	24	78	8	12	11	11	43	1
1 TO 25 PERCENT	106	3	3	27	8	32	3	4	5	2	22	0
26 TO 50 PERCENT	71	5	5	17	9	17	3	2	5	3	10	0
51 TO 75 PERCENT	35	5	5	11	4	10	0	2	0	2	1	0
MORE THAN 75 PERCENT	74	11	11	19	3	19	2	4	1	4	10	1
COLLECTOR/DEALER SOURCES	278	24	24	80	23	70	7	12	11	10	40	1
1 TO 25 PERCENT	71	12	12	16	6	16	0	4	2	3	11	1
26 TO 50 PERCENT	71	4	4	18	9	15	2	3	4	4	12	0
51 TO 75 PERCENT	50	4	4	12	5	13	1	2	2	2	9	0
MORE THAN 75 PERCENT	86	4	4	34	3	26	4	3	3	1	8	0
OVER-THE-SCALE SOURCES	186	16	16	33	20	44	4	7	12	10	39	1
1 TO 25 PERCENT	111	12	12	17	10	30	2	4	8	8	19	1
26 TO 50 PERCENT	33	4	4	6	5	6	2	2	1	1	6	0
51 TO 75 PERCENT	15	0	0	2	3	3	0	0	2	0	5	0
MORE THAN 75 PERCENT	27	0	0	8	2	5	0	1	1	1	9	0
VOLUME PROCSD NOT MELTED	314	26	26	79	29	79	10	13	13	13	51	1
UNDER 200 NET TONS	72	4	4	26	4	18	2	1	1	1	15	0
200 TO 500	44	4	4	6	6	11	2	2	0	6	7	0
500 TO 1,000	60	4	4	9	5	18	1	4	5	4	10	0
1,000 TO 3,000	61	8	8	11	8	14	5	3	3	1	8	0
3,000 TO 5,000	44	6	6	10	3	13	0	1	2	1	7	1
OVER 5,000	33	0	0	17	3	5	0	2	2	0	4	0
VOLUME SMELTD,MELTD,OTHER	131	8	8	43	10	34	4	4	6	4	18	0
UNDER 2,500 NET TONS	89	6	6	26	9	18	3	3	4	4	16	0
2,500 TO 5,000	12	1	1	3	0	6	1	0	0	0	1	0
5,000 TO 10,000	7	1	1	0	0	4	0	0	2	0	0	0
10,000 TO 20,000	9	0	0	4	1	3	0	0	0	0	1	0
20,000 TO 50,000	5	0	0	4	0	1	0	0	0	0	0	0
OVER 50,000	9	0	0	6	0	2	0	1	0	0	0	0
HANDLES LEAD	370	33	33	97	37	98	12	16	13	13	50	1
SCRAP RECEVD INDSTRAL SOURCES	201	19	19	44	18	60	5	10	10	10	25	0
1 TO 25 PERCENT	89	6	6	13	10	28	1	4	8	3	16	0
26 TO 50 PERCENT	41	4	4	12	3	11	2	1	2	3	3	0
51 TO 75 PERCENT	18	1	1	4	3	6	0	2	0	0	2	0
MORE THAN 75 PERCENT	53	8	8	15	2	15	2	3	0	4	4	0
COLLECTOR/DEALER SOURCES	224	20	20	51	24	62	5	11	11	9	30	1

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UNKNOWN	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST NORTH CENTRAL	EAST SOUTH CENTRAL	WEST NORTH CENTRAL	WEST SOUTH CENTRAL	MOUNTAIN	PACIFIC	OUTSID UNITED STATE
1 TO 25 PERCENT	56	7	7	12	4	12	2	3	3	3	10	0
26 TO 50 PERCENT	57	6	6	10	8	15	1	4	3	2	8	0
51 TO 75 PERCENT	31	3	3	4	6	8	1	1	3	1	4	0
MORE THAN 75 PERCENT	79	4	4	24	6	27	1	3	2	3	8	1
OVER-THE-SCALE SOURCES	170	15	15	30	17	40	5	6	12	9	35	1
1 TO 25 PERCENT	76	5	5	14	7	21	2	2	4	7	13	1
26 TO 50 PERCENT	29	6	6	3	4	6	0	3	3	1	3	0
51 TO 75 PERCENT	16	2	2	4	3	0	1	0	2	0	4	0
MORE THAN 75 PERCENT	49	2	2	9	3	13	2	1	3	1	15	0
VOLUME PROCSD NOT MELTED	266	22	22	55	27	76	8	11	13	11	42	1
UNDER 100 NET TONS	106	11	11	21	11	39	2	3	2	2	15	0
100 TO 200	34	3	3	5	5	9	2	2	2	5	1	0
200 TO 1,000	83	3	3	15	8	22	3	4	5	3	20	0
1,000 TO 2,000	18	1	1	6	2	2	0	1	1	1	3	1
2,000 TO 4,000	11	2	2	4	0	1	1	0	1	0	2	0
OVER 4,000	14	2	2	4	1	3	0	1	2	0	1	0
VOLUME SMELTD,MELTD,OTHER	136	6	6	30	12	46	4	5	8	6	19	0
UNDER 1,000 NET TONS	108	6	6	18	9	38	4	4	7	5	17	0
1,000 TO 2,000	10	0	0	4	1	3	0	0	0	1	1	0
2,000 TO 6,000	5	0	0	3	0	2	0	0	0	0	0	0
6,000 TO 10,000	3	0	0	1	1	1	0	0	0	0	0	0
10,000 TO 20,000	2	0	0	0	1	0	0	1	0	0	0	0
OVER 20,000	8	0	0	4	0	2	0	0	1	0	1	0
HANDLES ZINC	351	33	33	89	33	90	14	15	13	13	50	1
SCRAP RECEVD INDSTRAL SOURCES	351	33	33	89	33	90	14	15	13	13	50	1
1 TO 25 PERCENT	83	7	7	14	7	27	1	2	7	1	17	0
26 TO 50 PERCENT	31	3	3	7	3	8	1	1	1	4	3	0
51 TO 75 PERCENT	19	2	2	5	0	6	1	2	1	0	2	0
MORE THAN 75 PERCENT	80	12	12	18	5	18	4	6	1	6	9	1
COLLECTOR/DEALER SOURCES	195	16	16	47	14	56	6	10	10	9	27	0
1 TO 25 PERCENT	64	6	6	15	4	12	2	4	3	5	13	0
26 TO 50 PERCENT	41	5	5	9	2	9	2	3	2	3	6	0
51 TO 75 PERCENT	28	1	1	6	5	8	0	1	1	0	6	0
MORE THAN 75 PERCENT	62	4	4	17	3	27	2	2	4	1	2	0
OVER-THE-SCALE SOURCES	150	14	14	21	14	38	4	6	11	8	33	1
1 TO 25 PERCENT	76	6	6	11	7	24	2	5	5	6	9	1
26 TO 50 PERCENT	25	5	5	3	2	3	0	1	3	1	7	0
51 TO 75 PERCENT	10	1	1	2	1	2	0	0	0	0	4	0
MORE THAN 75 PERCENT	39	2	2	5	4	9	2	0	3	1	13	0
VOLUME PROCSD NOT MELTED	254	23	23	50	23	71	10	11	12	11	42	1
UNDER 50 NET TONS	95	15	15	18	10	19	4	6	2	7	14	0
50 TO 100	43	1	1	11	4	15	1	2	2	1	6	0
100 TO 500	88	7	7	12	8	32	5	1	6	3	13	1
500 TO 1,000	14	0	0	3	0	3	0	0	1	0	7	0
1,000 TO 2,000	8	0	0	3	1	1	0	2	0	0	1	0
OVER 2,000	6	0	0	3	0	1	0	0	1	0	1	0
VOLUME SMELTD,MELTD,OTHER	115	9	9	26	8	38	5	4	7	4	14	0
UNDER 500 NET TONS	82	9	9	13	5	27	4	2	6	4	12	0
500 TO 1,000	7	0	0	2	2	2	0	1	0	0	0	0
1,000 TO 2,000	9	0	0	5	0	1	1	1	0	0	1	0

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UNKNOWN	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST NORTH CENTRAL	EAST SOUTH CENTRAL	WEST NORTH CENTRAL	WEST SOUTH CENTRAL	MOUNTAIN	PACIFIC	OUTSID UNITED STATE
3.000 TO 5.000	6	0	0	2	1	2	0	0	1	0	0	0
5.000 TO 10.000	3	0	0	1	0	2	0	0	0	0	0	0
OVER 10.000	8	0	0	3	0	4	0	0	0	0	1	0
HANDLES NICKEL AND NICKEL ALOY	348	34	34	101	30	81	12	16	11	11	51	1
RECEIVED INDUSTRIAL SOURCES	225	26	26	58	19	53	7	10	10	10	31	1
1 TO 25 PERCENT	62	1	1	20	7	15	0	3	2	2	12	0
26 TO 50 PERCENT	44	5	5	12	1	12	1	1	3	4	5	0
51 TO 75 PERCENT	32	5	5	10	4	5	0	2	2	0	4	0
MORE THAN 75 PERCENT	87	15	15	16	7	21	6	4	3	4	10	1
COLLECTOR/DEALER SOURCES	210	19	19	61	17	50	3	9	10	7	34	0
1 TO 25 PERCENT	61	8	8	9	8	16	2	0	4	2	12	0
26 TO 50 PERCENT	53	5	5	19	3	9	1	2	3	2	9	0
51 TO 75 PERCENT	26	2	2	5	1	8	0	3	1	1	5	0
MORE THAN 75 PERCENT	70	4	4	28	5	17	0	4	2	2	8	0
OVER-THE-SCALE SOURCES	130	13	13	18	11	31	4	4	8	5	36	0
1 TO 25 PERCENT	90	12	12	12	6	22	3	4	6	4	21	0
26 TO 50 PERCENT	15	1	1	4	2	2	0	0	1	1	4	0
51 TO 75 PERCENT	7	0	0	1	1	2	0	0	1	0	2	0
MORE THAN 75 PERCENT	18	0	0	1	2	5	1	0	0	0	9	0
VOLUME NICKEL AND ALOY PROCSD	268	26	26	66	23	66	8	13	11	10	44	1
UNDER 20 TONS	71	5	5	12	5	19	4	5	2	3	16	0
20 TO 100	79	8	8	18	10	20	1	3	5	4	10	0
100 TO 300	57	8	8	17	5	11	2	1	2	2	8	1
300 TO 500	22	1	1	7	1	4	1	3	0	1	4	0
500 TO 1.000	17	2	2	6	0	4	0	0	1	0	4	0
OVER 1.000	22	2	2	6	2	8	0	1	1	0	2	0
HANDLES STAINLESS STEEL	345	31	31	85	34	86	13	15	13	13	54	1
RECEIVED INDUSTRIAL SOURCES	218	24	24	47	19	56	7	10	8	10	36	1
1 TO 25 PERCENT	61	2	2	16	8	21	0	0	3	2	9	0
26 TO 50 PERCENT	51	5	5	14	4	12	1	3	0	5	7	0
51 TO 75 PERCENT	28	3	3	5	1	7	0	0	3	0	8	1
MORE THAN 75 PERCENT	78	14	14	12	6	16	6	7	2	3	12	0
COLLECTOR/DEALER SOURCES	199	17	17	46	18	56	5	8	9	8	31	1
1 TO 25 PERCENT	60	7	7	10	5	17	3	3	2	2	10	1
26 TO 50 PERCENT	57	4	4	11	8	10	1	2	4	4	13	0
51 TO 75 PERCENT	30	5	5	10	0	10	0	1	1	0	3	0
MORE THAN 75 PERCENT	52	1	1	15	5	19	1	2	2	2	5	0
OVER-THE-SCALE SOURCES	154	13	13	24	17	38	4	6	9	8	34	1
1 TO 25 PERCENT	105	11	11	15	11	28	2	6	6	6	19	1
26 TO 50 PERCENT	22	2	2	4	4	2	0	0	1	1	8	0
51 TO 75 PERCENT	8	0	0	1	1	4	0	0	1	0	1	0
MORE THAN 75 PERCENT	19	0	0	4	1	4	2	0	1	1	6	0
VOLUME PROCESSED	254	23	23	49	25	68	8	11	11	11	47	1
UNDER 200 NET TONS	101	7	7	16	11	28	2	5	2	8	21	1
200 TO 1.000	103	11	11	17	12	27	5	3	7	2	19	0
1.000 TO 3.000	29	5	5	7	1	6	1	3	1	1	4	0
3.000 TO 5.000	6	0	0	2	0	3	0	0	0	0	1	0
5.000 TO 10.000	4	0	0	2	0	1	0	0	0	0	1	0
OVER 10.000	11	0	0	5	1	3	0	0	1	0	1	0
HANDLES PRECIOUS METALS	193	16	16	65	18	41	4	7	3	5	33	1

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN-KNOWN	NEW ENG-LAND	MID-DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN-TRAL	EAST SOUTH CEN-TRAL	WEST NORTH CEN-TRAL	WEST SOUTH CEN-TRAL	MOUN-TAIN	PAC-IFIC	OUTSID UNI-TED STATE
RECEIVED INDUSTRIAL SOURCES	94	10	10	25	7	21	0	3	3	3	21	1
1 TO 25 PERCENT	15	1	1	2	2	4	0	0	1	0	5	0
26 TO 50 PERCENT	16	2	2	5	2	3	0	0	1	1	2	0
51 TO 75 PERCENT	5	0	0	1	1	1	0	0	0	0	1	1
MORE THAN 75 PERCENT	58	7	7	17	2	13	0	3	1	2	13	0
RECEIVED COLLECTOR/DEALER	79	9	9	25	7	17	0	1	3	3	14	0
1 TO 25 PERCENT	30	4	4	9	2	3	0	0	1	1	10	0
26 TO 50 PERCENT	16	3	3	5	3	3	0	0	1	1	0	0
51 TO 75 PERCENT	7	1	1	1	1	1	0	1	0	0	2	0
MORE THAN 75 PERCENT	26	1	1	10	1	10	0	0	1	1	2	0
RECEIVED OVER-THE-SCALE	41	4	4	5	3	8	1	1	3	2	13	1
1 TO 25 PERCENT	23	1	1	3	1	6	0	0	3	2	6	1
26 TO 50 PERCENT	8	3	3	2	1	1	0	1	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	10	0	0	0	1	1	1	0	0	0	7	0
VOLM PROCSD NOT REFIND-WEIGHT	112	9	9	28	11	26	1	4	2	5	25	1
UNDER 2 NET TONS	61	6	6	11	3	20	1	2	2	4	11	1
2 TO 5	11	0	0	3	3	0	0	1	0	1	3	0
5 TO 10	13	0	0	2	2	4	0	1	0	0	4	0
10 TO 15	5	0	0	2	1	0	0	0	0	0	2	0
15 TO 20	2	0	0	0	0	0	0	0	0	0	2	0
OVER 20	20	3	3	10	2	2	0	0	0	0	3	0
PROCSD NOT REFIND-SOLUTIONS	41	5	5	17	0	9	0	1	0	0	9	0
UNDER 100 GALLONS	24	2	2	8	0	6	0	1	0	0	7	0
100 TO 1.000	6	0	0	4	0	1	0	0	0	0	1	0
1.000 TO 5.000	5	2	2	0	0	2	0	0	0	0	1	0
5.000 TO 10.000	5	1	1	4	0	0	0	0	0	0	0	0
OVER 10.000	1	0	0	1	0	0	0	0	0	0	0	0
VOLUME GOLD REFINED	53	5	5	18	2	9	0	1	1	2	14	1
UNDER 500 TROY OZ	30	3	3	7	2	7	0	0	1	1	9	0
500 TO 1.000	2	0	0	1	0	0	0	0	0	1	0	0
1.000 TO 2.000	2	0	0	0	0	0	0	0	0	0	2	0
2.000 TO 5.000	5	0	0	2	0	0	0	1	0	0	1	1
5.000 TO 25.000	5	0	0	3	0	1	0	0	0	0	1	0
OVER 25.000	9	2	2	5	0	1	0	0	0	0	1	0
VOLUME SILVER REFINED	70	5	5	22	4	15	0	1	2	3	17	1
UNDER 500 TROY OZ	21	0	0	4	1	7	0	0	0	1	8	0
500 TO 1.000	11	1	1	2	1	3	0	0	1	0	3	0
1.000 TO 2.000	5	1	1	1	0	0	0	1	0	0	2	0
2.000 TO 5.000	4	0	0	2	0	1	0	0	0	1	0	0
5.000 TO 25.000	11	0	0	5	1	2	0	0	0	0	2	1
OVER 25.000	18	3	3	8	1	2	0	0	1	1	2	0
VOLUME PLATINUM REFINED	49	4	4	18	2	8	0	1	1	1	14	0
UNDER 500 TROY OZ	32	4	4	5	2	6	0	1	1	1	12	0
500 TO 1.000	4	0	0	4	0	0	0	0	0	0	0	0
1.000 TO 2.000	2	0	0	1	0	1	0	0	0	0	0	0
2.000 TO 5.000	3	0	0	3	0	0	0	0	0	0	0	0
5.000 TO 25.000	3	0	0	1	0	0	0	0	0	0	2	0
OVER 25.000	5	0	0	4	0	1	0	0	0	0	0	0
HANDLES EXOTIC METALS	207	25	25	60	15	51	5	7	6	4	34	0

SECONDARY MATERIALS INDUSTRY CENSUS 04/21/71

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN-KNOWN	NEW ENG-LAND	MID-DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN-TRAL	EAST SOUTH CEN-TRAL	WEST NORTH CEN-TRAL	WEST SOUTH CEN-TRAL	MOUN-TAIN	PAC-IFIC	OUTSID UNI-TED STATE
RECEIVED INDUSTRIAL SOURCES	117	18	18	29	7	27	1	4	5	2	24	0
1 TO 25 PERCENT	23	3	3	4	0	5	0	1	2	0	8	0
26 TO 50 PERCENT	18	2	2	8	0	5	0	0	0	1	2	0
51 TO 75 PERCENT	13	0	0	4	0	3	0	2	1	0	3	0
MORE THAN 75 PERCENT	63	13	13	13	7	14	1	1	2	1	11	0
RECEIVED COLLECTOR/DEALER	81	10	10	27	3	19	0	2	5	2	13	0
1 TO 25 PERCENT	26	3	3	9	3	4	0	0	1	0	6	0
26 TO 50 PERCENT	25	3	3	9	0	4	0	1	2	1	5	0
51 TO 75 PERCENT	8	1	1	2	0	3	0	1	0	0	1	0
MORE THAN 75 PERCENT	22	3	3	7	0	8	0	0	2	1	1	0
RECEIVED OVER-THE-SCALE	43	5	5	4	0	7	1	2	4	1	19	0
1 TO 25 PERCENT	27	3	3	4	0	5	0	1	4	1	9	0
26 TO 50 PERCENT	7	2	2	0	0	0	0	1	0	0	4	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	9	0	0	0	0	2	1	0	0	0	6	0
VOLUME PROCESSED	125	18	18	29	8	31	2	3	6	3	25	0
UNDER 5 NET TONS	50	8	8	7	4	18	1	0	1	2	9	0
5 TO 10	12	1	1	3	0	1	0	2	1	0	4	0
10 TO 25	18	2	2	6	0	5	0	0	1	1	3	0
25 TO 50	10	1	1	2	1	1	1	0	1	0	3	0
50 TO 100	11	2	2	2	2	1	0	0	1	0	3	0
OVER 100	24	4	4	9	1	5	0	1	1	0	3	0
HANDLES PAPER	173	15	15	53	20	44	5	5	6	2	22	1
PURCHSD MANUFR CONVRT PRNT PL	173	15	15	53	20	44	5	5	6	2	22	1
1 TO 25 PERCENT	34	4	4	6	6	7	1	2	1	0	7	0
26 TO 50 PERCENT	15	0	0	2	2	7	1	1	0	1	1	0
51 TO 75 PERCENT	17	1	1	5	0	9	1	0	0	0	1	0
MORE THAN 75 PERCENT	30	4	4	7	3	13	1	2	0	0	0	0
PURCHASED FROM OFFICE BLDGS	35	3	3	8	4	9	2	3	2	1	3	0
1 TO 25 PERCENT	34	3	3	8	4	8	2	3	2	1	3	0
26 TO 50 PERCENT	1	0	0	0	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
PURCHSD SUPRMRK,DEPT.STOR,ETC	55	5	5	8	7	16	4	4	2	1	8	0
1 TO 25 PERCENT	44	2	2	8	4	14	4	4	2	1	5	0
26 TO 50 PERCENT	8	2	2	0	3	2	0	0	0	0	1	0
51 TO 75 PERCENT	2	1	1	0	0	0	0	0	0	0	1	0
MORE THAN 75 PERCENT	1	0	0	0	0	0	0	0	0	0	1	0
PURCHSD COLLECTOR/DEALER	83	7	7	18	9	29	4	4	2	0	10	0
1 TO 25 PERCENT	42	3	3	6	5	16	3	4	1	0	4	0
26 TO 50 PERCENT	22	2	2	5	3	9	0	0	0	0	3	0
51 TO 75 PERCENT	4	0	0	1	0	3	0	0	0	0	0	0
MORE THAN 75 PERCENT	15	2	2	6	1	1	1	0	1	0	3	0
PURCHSD FROM OVER-THE-SCALE	66	5	5	8	9	24	3	4	4	1	8	0
1 TO 25 PERCENT	42	3	3	6	3	19	2	1	1	1	6	0
26 TO 50 PERCENT	13	1	1	1	3	4	0	2	1	0	1	0
51 TO 75 PERCENT	3	0	0	1	1	0	0	0	0	0	1	0
MORE THAN 75 PERCENT	8	1	1	0	2	1	1	1	2	0	0	0
PURCHASED FROM OTHER SOURCES	7	0	0	2	0	2	0	2	0	0	1	0
1 TO 25 PERCENT	7	0	0	2	0	2	0	2	0	0	1	0

SECONDARY MATERIALS INDUSTRY-CENSUS 04/21/71

ABSOLUTE TALLY CLASSIFIED HY RASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN- KNOWN	NEW ENG- LAND	MID- DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN- TRAL	EAST SOUTH CEN- TRAL	WEST NORTH CEN- TRAL	WEST SOUTH CEN- TRAL	MOUN- TAIN	PAC- IFIC	OUTSID UNI- TED STATE
26 TO 50 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
RECVD FROM ORGANIZ.INSTUTNL	76	7	7	13	8	25	3	5	3	1	11	0
1 TO 25 PERCENT	51	6	6	7	4	21	1	3	1	1	7	0
26 TO 50 PERCENT	7	0	0	3	1	1	0	0	1	0	1	0
51 TO 75 PERCENT	5	0	0	3	1	0	0	0	1	0	0	0
MORE THAN 75 PERCENT	13	1	1	0	2	3	2	2	0	0	3	0
RECEIVED FROM MUNICIPAL WASTE	24	2	2	7	3	2	1	1	2	1	5	0
1 TO 25 PERCENT	14	2	2	4	2	2	0	1	0	1	2	0
26 TO 50 PERCENT	4	0	0	2	1	0	0	0	1	0	0	0
51 TO 75 PERCENT	2	0	0	0	0	0	0	0	1	0	1	0
MORE THAN 75 PERCENT	4	0	0	1	0	0	1	0	0	0	2	0
TONNAGE OF PAPER PURCHASED	109	10	10	25	13	35	5	5	4	1	11	0
0 TO 25.000 NET TONS	30	3	3	6	7	9	3	0	1	0	1	0
25.000 TO 50.000	31	2	2	7	4	12	1	2	0	0	3	0
50.000 TO 75.000	16	2	2	4	0	6	0	0	3	0	1	0
75.000 TO 100.000	8	3	3	2	0	0	0	1	0	0	2	0
100.000 TO 125.000	7	0	0	1	0	2	0	1	0	1	2	0
125.000 TO 150.000	2	0	0	0	1	1	0	0	0	0	0	0
150.000 TO 175.000	2	0	0	1	0	0	0	1	0	0	0	0
175.000 TO 200.000	1	0	0	1	0	0	0	0	0	0	0	0
OVER 200.000	12	0	0	3	1	5	1	0	0	0	2	0
TOTAL TONNAGE PHYSCALY HNDLED	89	9	9	17	12	29	4	4	4	1	9	0
1 TO 25 PERCENT	26	3	3	6	2	12	0	2	0	0	1	0
26 TO 50 PERCENT	17	2	2	4	1	7	0	0	0	0	3	0
51 TO 75 PERCENT	14	1	1	3	3	2	1	1	1	0	2	0
MORE THAN 75 PERCENT	32	3	3	4	6	8	3	1	3	1	3	0
TONNAGE COULD PHYSCALY HNDLED	91	10	10	19	10	30	4	5	3	1	9	0
0 TO 6.000 NET TONS	21	2	2	5	1	8	2	1	0	0	2	0
6.000 TO 10.000	4	1	1	0	2	1	0	0	0	0	0	0
10.000 TO 15.000	6	0	0	2	1	2	0	1	0	0	0	0
15.000 TO 20.000	6	2	2	0	2	1	0	0	0	0	1	0
21.000 TO 25.000	9	2	2	1	2	3	1	0	0	0	0	0
25.000 TO 35.000	9	1	1	3	1	3	0	0	1	0	0	0
35.000 TO 50.000	11	1	1	2	0	5	1	1	1	0	0	0
OVER 50.000	25	1	1	6	1	7	0	2	1	1	6	0
HOURS OPERATED PER WEEK	99	9	9	20	13	31	4	5	4	1	12	0
LESS THAN 35 HOURS	3	0	0	1	0	2	0	0	0	0	0	0
36 TO 40 HOURS	15	0	0	4	6	2	0	2	1	0	0	0
41 TO 45 HOURS	38	2	2	7	7	14	4	1	0	0	3	0
OVER 45 HOURS	42	7	7	7	0	13	0	2	3	1	9	0
HNDLS TEXTLS.MILL CUTNGS.RAGS	126	6	6	48	14	23	5	6	4	2	17	1
RECEIVED FROM INDUSTRL SOURCE	41	2	2	12	7	9	2	4	0	1	3	0
1 TO 25 PERCENT	13	1	1	4	1	4	1	1	0	1	0	0
26 TO 50 PERCENT	5	1	1	0	1	3	0	0	0	0	0	0
51 TO 75 PERCENT	2	0	0	1	1	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	20	0	0	7	4	2	1	3	0	0	3	0
RECEIVED COLLECTOR/DEALER	41	2	2	17	5	8	1	3	1	2	2	0
1 TO 25 PERCENT	25	1	1	8	5	3	1	3	0	2	2	0

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SECONDARY MATERIALS INDUSTRY CENSUS 04/21/71

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN-KNOWN	NEW ENG-LAND	MID-DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN-TRAL	EAST SOUTH CEN-TRAL	WEST NORTH CEN-TRAL	WEST SOUTH CEN-TRAL	MOUN-TAIN	PAC-IFIC	OUTSID UNI-TED STATE
26 TO 50 PERCENT	3	0	0	1	0	2	0	0	0	0	0	0
51 TO 75 PERCENT	2	1	1	0	0	1	0	0	0	0	0	0
MORE THAN 75 PERCENT	11	0	0	8	0	2	0	0	1	0	0	0
RECVD ORGANZTN AND INSTITUTN	28	2	2	4	4	8	1	3	2	2	2	0
1 TO 25 PERCENT	8	1	1	2	1	2	0	1	1	0	0	0
26 TO 50 PERCENT	5	1	1	1	0	3	0	0	0	0	0	0
51 TO 75 PERCENT	5	0	0	0	2	0	1	1	0	0	1	0
MORE THAN 75 PERCENT	10	0	0	1	1	3	0	1	1	2	1	0
TONNAGE PHYSICALLY HANDLED	51	2	2	15	8	11	2	4	2	2	5	0
1 TO 25 PERCENT	1	0	0	0	0	1	0	0	0	0	0	0
26 TO 50 PERCENT	3	1	1	1	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	5	0	0	4	1	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	42	1	1	10	7	9	2	4	2	2	5	0
COTTON CUTTINGS AND RUGS	47	2	2	16	8	8	2	5	2	2	4	0
UNDER 5,000,000 POUNDS	24	2	2	5	4	6	0	2	1	1	2	0
5,000,000 TO 10,000,000	11	0	0	3	3	0	1	2	1	1	0	0
10,000,000 TO 25,000,100	8	0	0	3	0	1	1	1	0	0	2	0
OVER 25,000,000	4	0	0	2	1	1	0	0	0	0	0	0
VOLUME WAS NEW MATERIAL	42	2	2	15	8	7	2	4	0	0	3	0
1 TO 25 PERCENT	12	0	0	3	3	4	0	1	0	0	1	0
26 TO 50 PERCENT	3	1	1	0	0	1	1	0	0	0	0	0
51 TO 75 PERCENT	2	0	0	1	1	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	25	1	1	12	4	2	1	3	0	0	2	0
VOLUME WAS OLD MATERIAL	32	2	2	8	4	7	1	2	2	2	4	0
1 TO 25 PERCENT	6	1	1	3	1	0	0	0	0	0	1	0
26 TO 50 PERCENT	3	1	1	1	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	4	0	0	0	1	1	1	0	0	0	1	0
MORE THAN 75 PERCENT	19	0	0	4	2	5	0	2	2	2	2	0
PROCSD WOOL RAG CUTTING,RAGS	40	2	2	12	6	7	2	4	1	1	5	0
UNDER 5,000,000 POUNDS	35	2	2	10	5	6	2	4	1	1	4	0
5,000,000 TO 10,000,000	3	0	0	2	0	0	0	0	0	0	1	0
10,000,000 TO 25,000,000	1	0	0	0	0	1	0	0	0	0	0	0
OVER 25,000,000	1	0	0	0	1	0	0	0	0	0	0	0
VOLUME WAS NEW MATERIAL	27	1	1	9	5	4	2	3	0	0	3	0
1 TO 25 PERCENT	7	0	0	2	1	1	1	1	0	0	1	0
26 TO 50 PERCENT	1	0	0	0	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	2	1	1	0	0	0	0	0	0	0	1	0
MORE THAN 75 PERCENT	17	0	0	7	4	2	1	2	0	0	1	0
VOLUME WAS OLD MATERIAL	23	1	1	5	3	5	1	2	1	1	4	0
1 TO 25 PERCENT	2	0	0	1	0	0	0	0	0	0	1	0
26 TO 50 PERCENT	2	1	1	0	0	1	0	0	0	0	0	0
51 TO 75 PERCENT	0	0	0	0	0	0	0	0	0	0	0	0
MORE THAN 75 PERCENT	19	0	0	4	3	4	1	2	1	1	3	0
PROCSD SYNTHETIC CUTTINGS,RAGS	44	2	2	14	9	7	2	3	1	1	5	0
UNDER 5,000,000 POUNDS	37	2	2	11	7	7	1	2	1	1	5	0
5,000,000 TO 10,000,000	5	0	0	3	2	0	0	0	0	0	0	0
10,000,000 TO 25,000,000	2	0	0	0	0	0	1	1	0	0	0	0
OVER 25,000,000	0	0	0	0	0	0	0	0	0	0	0	0
NEW MATERIAL	38	2	2	13	9	6	2	3	0	0	3	0
1 TO 25 PERCENT	8	1	1	2	1	2	0	1	0	0	1	0

ABSOLUTE TALLY CLASSIFIED BY BASIC ANSWERS TO QUESTIONS IN TERMS OF REGION OF RESPONDENT

	TOTAL	UN- KNOWN	NEW ENG- LAND	MID- DLE ATLAN TIC	SOUTH ATLAN TIC	EAST NORTH CEN- TRAL	EAST SOUTH CEN- TRAL	WEST NORTH CEN- TRAL	WEST SOUTH CEN- TRAL	MOUN- TAIN	PAC- IFIC	OUTSID UNI- TED STATE
26 TO 50 PERCENT	6	0	0	1	2	2	1	0	0	0	0	0
51 TO 75 PERCENT	1	0	0	0	0	0	0	0	0	0	1	0
MORE THAN 75 PERCENT	23	1	1	10	6	2	1	2	0	0	1	0
OLD MATERIAL	23	2	2	4	3	6	1	1	1	1	4	0
1 TO 25 PERCENT	2	1	1	0	0	0	0	0	0	0	1	0
26 TO 50 PERCENT	5	0	0	1	2	2	0	0	0	0	0	0
51 TO 75 PERCENT	2	1	1	0	0	0	1	0	0	0	0	0
MORE THAN 75 PERCENT	14	0	0	3	1	4	0	1	1	1	3	0
BLENDED WITH COTTON,WOOL,ETC	47	2	2	16	9	8	2	3	1	1	5	0
UNDER 5,000,000 POUNDS	33	2	2	10	6	7	1	2	1	0	4	0
5,000,000 TO 10,000,000	8	0	0	3	2	1	0	0	0	1	1	0
10,000,000 TO 25,000,000	5	0	0	3	0	0	1	1	0	0	0	0
OVER 25,000,000	1	0	0	0	1	0	0	0	0	0	0	0
NEW MATERIAL	40	2	2	16	9	6	2	2	0	0	3	0
1 TO 25 PERCENT	8	1	1	3	1	2	0	0	0	0	1	0
26 TO 50 PERCENT	4	0	0	1	0	2	1	0	0	0	0	0
51 TO 75 PERCENT	1	0	0	0	0	0	0	0	0	0	1	0
MORE THAN 75 PERCENT	27	1	1	12	8	2	1	2	0	0	1	0
OLD MATERIAL	26	1	1	6	2	8	1	1	1	1	5	0
1 TO 25 PERCENT	3	0	0	1	1	0	0	0	0	0	1	0
26 TO 50 PERCENT	3	0	0	1	0	2	0	0	0	0	0	0
51 TO 75 PERCENT	3	1	1	0	1	0	1	0	0	0	0	0
MORE THAN 75 PERCENT	17	0	0	4	0	6	0	1	1	1	4	0

Analysis by Operation

Table Number

A-1 Plant Area of Outdoor Storage
A-2 Plant Area Under Roof
A-3 Value of Plant and Equipment
A-4 1969 Gross Sales Revenue
A-5 Number of Employees.

TABLE A-1. PERCENTAGE DISTRIBUTION OF RECYCLING INDUSTRY COMPANIES BY SIZE OF OUTDOOR STORAGE AREA

	Area of Outdoor Storage				
Type of Operation	Total	One Acre	Two Acres	Three to Five Acres	More than Five Acres
Nonferrous Scrap D-P	100.0	13.7	12.6	25.2	48.5
Nonferrous Metal Broker	100.0	8.6	14.7	25.0	51.7
Smelter and Refiner	100.0	13.5	12.5	22.9	51.0
Ingot Maker	100.0	10.8	16.2	18.9	54.1
Brass Mill	100.0	18.5	14.8	18.5	48.1
Scrap Iron P & B	100.0	7.8	10.5	22.9	58.8
Sweater	100.0	5.8	11.5	11.5	71.2
Importer & Exporter	100.0	9.7	14.5	27.4	48.4
Paper Stock D-P	100.0	11.1	30.2	33.3	25.4
Paper Stock Broker	100.0	13.7	35.3	25.5	25.5
Textile D-P	100.0	9.1	22.7	22.7	45.5
Textile Broker	100.0	11.1	11.1	22.2	55.6
Textile Garnetter	100.0	33.3	0.0	0.0	66.7
Other Function	100.0	8.6	14.3	22.9	54.3

TABLE A-2. PERCENTAGE DISTRIBUTION OF RECYCLING INDUSTRY COMPANIES BY SIZE OF AREA UNDER ROOF

		Area Under Roof, Square Feet				
Type of Operation	Total	1 To 5000	5001 To 10000	10001 To 25000	25001 To 50000	More Than 50000
Nonferrous Scrap D-P	100.0	13.1	13.7	31.9	18.8	22.4
Nonferrous Metal Broker	100.0	6.4	13.6	33.6	20.7	25.7
Smelter and Refiner	100.0	7.8	7.8	26.1	24.3	33.9
Ingot Maker	100.0	2.5	10.0	17.5	17.5	52.5
Brass Mill	100.0	10.3	13.8	34.5	6.9	34.5
Scrap Iron P & B	100.0	12.7	15.9	32.5	20.4	18.5
Sweater	100.0	5.5	12.7	36.4	18.2	27.3
Importer & Exporter	100.0	3.8	14.1	28.2	19.2	34.6
Paper Stock D-P	100.0	4.9	4.9	29.6	24.7	35.8
Paper Stock Broker	100.0	7.5	3.0	23.9	23.9	41.8
Textile D-P	100.0	4.5	2.3	13.6	13.6	65.9
Textile Broker	100.0	5.3	0.0	15.8	5.3	73.7
Textile Garnetter	100.0	0.0	20.0	0.0	20.0	60.0
Other Function	100.0	15.0	15.0	25.0	15.0	30.0

TABLE A-3. PERCENTAGE DISTRIBUTION OF RECYCLING INDUSTRY COMPANIES BY VALUE OF PLANT AND EQUIPMENT

		Total Value of Plant & Equipment, thousands of dollars						
Type of Operation	Total	1 To 250	251 To 500	501 To 1000	1001 To 2000	2001 To 7000	7001 To 10000	More Than 10000
Nonferrous Scrap D-P	100.0	35.6	16.9	21.8	14.2	8.8	1.5	1.1
Nonferrous Metal Broker	100.0	34.2	12.6	22.5	14.4	13.5	0.9	1.8
Smelter and Refiner	100.0	29.2	10.4	15.6	17.7	15.6	3.1	8.3
Ingot Maker	100.0	22.9	8.6	14.3	28.6	17.1	2.9	5.7
Brass Mill	100.0	40.0	12.0	12.0	16.0	8.0	4.0	8.0
Scrap Iron P & B	100.0	26.5	15.4	25.0	19.9	11.8	1.5	0.0
Sweater	100.0	18.7	12.5	22.9	25.0	18.7	2.1	0.0
Importer & Exporter	100.0	27.1	17.1	18.6	22.9	11.4	2.9	0.0
Paper Stock D-P	100.0	32.9	23.3	17.8	15.1	9.6	0.0	1.4
Paper Stock Broker	100.0	32.2	25.4	16.9	13.6	10.2	0.0	1.7
Textile D-P	100.0	40.0	15.0	22.5	17.5	5.0	0.0	0.0
Textile Boker	100.0	31.6	31.6	15.8	10.5	10.5	0.0	0.0
Textile Garnetter	100.0	0.0	40.0	0.0	20.0	40.0	0.0	0.0
Other Function	100.0	27.0	18.9	21.6	24.3	8.1	0.0	0.0

TABLE A-4. PERCENTAGE DISTRIBUTION OF RECYCLING INDUSTRY COMPANIES BY SIZE CLASS IN TERMS OF 1969 SALES

Type of Operation	Total	Total 1969 Gross Sales, million dollars								
		Under $1	$1 To $3	$3 To $5	$5 To $8	$8 To $12	$12 To $20	$20 To $30	$30 To $50	Over $50
Nonferrous Scrap D-P	100.0	18.6	28.7	19.9	12.9	5.7	7.9	1.9	2.8	1.6
Nonferrous Metal Broker	100.0	14.2	20.6	21.9	12.3	11.6	11.0	3.2	3.2	1.9
Smelter and Refiner	100.0	10.5	22.8	16.7	14.9	5.3	11.4	4.4	7.9	6.1
Ingot Maker	100.0	7.1	19.0	11.9	19.0	14.3	11.9	4.8	9.5	2.4
Brass Mill	100.0	10.7	25.0	17.9	7.1	7.1	17.9	0.0	7.1	7.1
Scrap Iron P & B	100.0	16.1	30.3	20.6	12.9	7.7	4.5	1.9	3.2	2.6
Sweater	100.0	11.8	29.4	23.5	9.8	9.8	5.9	5.9	3.9	0.0
Importer & Exporter	100.0	9.4	21.9	22.9	11.5	16.7	9.4	3.1	4.2	1.0
Paper Stock D-P	100.0	29.3	43.9	9.8	6.1	6.1	2.4	0.0	2.4	0.0
Paper Stock Broker	100.0	21.3	42.7	12.0	12.0	8.0	2.7	0.0	1.3	0.0
Textile D-P	100.0	12.8	57.4	12.8	10.6	6.4	0.0	0.0	0.0	0.0
Textile Broker	100.0	17.4	47.8	17.4	13.0	4.3	0.0	0.0	0.0	0.0
Textile Garnetter	100.0	0.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Other Function	100.0	20.0	33.3	20.0	8.9	11.1	2.2	2.2	2.2	0.0

TABLE A-5. PERCENTAGE DISTRIBUTION OF RECYCLING INDUSTRY COMPANIES IN TERMS OF EMPLOYEES

Type of Operation	Company Size Class, Number of Employees				
	Total	1 To 50	51 To 100	101 To 150	More Than 150
Nonferrous Scrap D-P	100.0	73.2	16.8	4.0	6.1
Nonferrous Metal Broker	100.0	71.3	18.3	6.1	4.3
Smelter and Refiner	100.0	54.1	16.4	9.8	19.7
Ingot Maker	100.0	39.0	31.7	17.1	12.2
Brass Mill	100.0	61.3	29.0	0.0	9.7
Scrap Iron P & B	100.0	63.4	23.8	5.5	7.3
Sweater	100.0	56.4	30.9	3.6	9.1
Importer & Exporter	100.0	68.4	18.4	5.1	8.2
Paper Stock D-P	100.0	70.1	18.4	2.3	9.2
Paper Stock Broker	100.0	73.1	15.4	3.8	7.7
Textile D-P	100.0	47.9	29.2	12.5	10.4
Textile Broker	100.0	56.5	26.1	4.3	13.0
Textile Garnetter	100.0	37.5	12.5	12.5	37.5
Other Function	100.0	58.1	30.2	2.3	9.3

Analysis by Geographic Region

Table Number

A-6	Plant Area
A-7	1969 Gross Sales
A-8	Value of Plant and Equipment.

TABLE A-6. REGIONAL DISTRIBUTION OF RECYCLING COMPANIES BY PLANT AREA

	Total	New England	Middle Atlantic	South Atlantic	East North Central	East South Central	West North Central	West South Central	Mountain	Pacific	Outside U.S.
Area of Outdoor Storage	100.0	7.8	29.6	8.7	26.3	3.3	4.2	3.1	2.9	14.0	0.2
1 Acre	100.0	7.7	26.9	5.8	19.2	3.8	3.8	3.8	3.8	25.0	0.0
2 Acres	100.0	12.9	16.1	8.1	27.4	3.2	3.2	1.6	6.5	21.0	0.0
3 to 5 Acres	100.0	7.1	24.2	9.1	32.3	2.0	4.0	4.0	0.0	17.2	0.0
6 to 10	100.0	7.6	25.8	12.1	30.3	6.1	3.0	6.1	4.5	3.0	1.5
11 to 15	100.0	12.8	15.4	5.1	30.8	2.6	7.7	7.7	7.7	10.3	0.0
More than 15	100.0	5.3	22.4	11.8	33.3	7.9	3.9	3.9	2.6	11.8	0.0
Area Under Roof	100.0	7.8	29.6	8.7	26.3	3.3	4.2	3.1	2.9	14.0	0.2
Less than 5000 sq ft	100.0	5.6	18.5	13.0	20.4	1.9	1.9	1.9	5.6	29.6	1.9
5001 to 10000 sq ft	100.0	7.2	21.7	2.9	27.5	1.4	5.8	1.4	4.3	26.1	1.4
10001 to 25000 sq ft	100.0	10.9	25.4	8.0	23.2	5.1	1.4	6.5	3.6	15.9	0.0
25001 to 50000 sq ft	100.0	10.5	25.3	10.5	27.4	4.2	5.3	3.2	4.2	9.5	0.0
More than 50000 sq ft	100.0	5.2	27.5	13.1	34.6	2.6	7.2	3.3	1.3	5.2	0.0

TABLE A-7. REGIONAL DISTRIBUTION OF RECYCLING COMPANIES BY GROSS SALES

	Total	New England	Middle Atlantic	South Atlantic	East North Central	East South Central	West North Central	West South Central	Mountain	Pacific	Outside U.S.
Total 1969 Gross Sales	100.0	7.5	28.5	8.6	26.8	3.4	4.1	3.2	3.0	14.6	0.2
Under $1,000,000	100.0	8.6	20.4	6.5	22.6	5.4	5.4	3.2	4.3	23.7	0.0
$1,000,000 to $3,000,000	100.0	9.1	21.2	9.7	32.1	3.0	4.2	1.8	4.2	13.9	0.6
$3,000,000 to $5,000,000	100.0	7.5	37.6	12.9	18.3	2.2	4.3	4.3	2.2	10.8	0.0
$5,000,000 to $8,000,000	100.0	4.9	26.2	8.2	27.9	8.2	1.6	4.9	1.6	16.4	0.0
$8,000,000 to $12,000,000	100.0	8.1	35.1	5.4	24.3	0.0	5.4	0.0	2.7	18.9	0.0
$12,000,000 to $20,000,000	100.0	7.7	35.9	7.7	30.8	0.0	2.6	2.6	0.0	12.8	0.0
$20,000,000 to $30,000,000	100.0	8.3	25.0	8.3	16.7	8.3	8.3	16.7	0.0	8.3	0.0
$30,000,000 to $50,000,000	100.0	0.0	50.0	5.0	40.0	0.0	0.0	0.0	5.0	0.0	0.0
Over $50,000,000	100.0	0.0	53.8	0.0	30.8	0.0	7.7	7.7	0.0	0.0	0.0

TABLE A-8. REGIONAL DISTRIBUTION OF RECYCLING COMPANIES
BY VALUE OF PLANT AND EQUIPMENT

	Total	New England	Middle Atlantic	South Atlantic	East North Central	East South Central	West North Central	West South Central	Mountain	Pacific	Outside U.S.
Total Value of Plant and Equipment	100.0	8.2	23.7	9.8	27.1	2.9	5.0	3.8	3.6	15.6	0.2
Less Than $250,000	100.0	10.5	21.1	7.9	28.1	0.9	3.5	0.9	4.4	21.9	0.9
$250,000 to $500,000	100.0	10.7	19.4	12.6	22.3	5.8	5.8	4.9	3.9	14.6	0.0
$501,000 to $1,000,000	100.0	10,4	24.7	9.1	23.4	1.3	5.2	9.1	2.6	14.3	0.0
$1,001,000 to $2,000,000	100.0	1.7	36.2	10.6	29.8	0.0	4.3	2.1	4.3	12.8	0.0
$2,001,000 to $7,000,000	100.0	0.0	36.2	10.6	29.8	0.0	4.3	2.1	4.3	12.8	0.0
$7,001,000 to $10,000,000	100.0	14.3	14.3	0.0	42.9	0.0	0.0	0.0	0.0	28.6	0.0
Over $10,000,000	100.0	9.1	36.4	0.0	45.5	9.1	0.0	0.0	0.0	0.0	0.0

Analysis by Commodity

Table Number	
A-9	Value of Plant and Equipment
A-10	1969 Gross Sales

TABLE A-9. SCRAP COMMODITY PROCESSORS CLASSIFIED BY VALUE, PLANT, AND EQUIPMENT
(Percent of Companies in Category - N = 578)

Category	Value, Plant, and Equipment (1000's of $) Less Than 250	250-500	501-1000	1001-2000	2001-7000	7001-10,000	More Than 10,000	Number of Companies in Category Sample
Aluminum Scrap Processor	34.4	16.4	21.5	14.5	10.9	0.8	1.6	256
Aluminum Scrap Smelter, Melter, Consumer	26.4	14.0	19.4	19.4	14.7	1.6	4.7	129
Copper/Brass Scrap Processor	36.4	15.1	21.7	15.1	8.9	1.2	1.6	258
Copper/Brass Smelter, Melter, Consumer	25.5	13.7	22.5	18.6	12.7	1.0	5.9	102
Lead Scrap Processor	34.5	15.0	22.3	15.9	10.0	0.9	1.4	220
Lead Scrap Smelter, Melter, Consumer	27.4	12.3	19.8	22.6	13.2	1.9	2.8	106
Zinc Scrap Processor	35.1	18.3	20.7	14.9	9.6	1.0	0.5	208
Zinc Scrap Smelter, Melter, Consumer	30.2	11.6	16.3	24.4	14.0	1.2	2.3	86
Nickel/Alloy Scrap Processor	34.7	17.6	19.9	15.7	9.7	1.4	0.9	216
Stainless Steel Scrap Processor	36.4	15.9	21.0	15.0	9.8	1.4	0.5	214
Precious Metal Processor	39.5	15.1	20.9	14.0	5.8	1.2	3.5	86
Gold Refiner	29.3	19.5	24.4	14.6	2.4	2.4	7.3	41
Silver Refiner	31.5	18.5	24.1	14.8	3.7	1.9	5.6	54
Platinum Refiner	24.3	18.9	27.0	16.2	2.7	2.7	8.1	37
Exotic Metal Scrap Processor	32.4	20.6	19.6	11.8	13.7	2.0	0.0	102
Paper	32.0	28.0	17.3	14.7	6.7	0.0	1.3	75
Textiles	40.5	16.7	21.4	16.7	4.8	0.0	0.0	42
TOTAL ALL CATEGORIES	33.3	8.7	18.5	13.9	11.3	1.7	2.6	417

Source: BCL - Secondary Materials Industry Census.

TABLE A-10. SCRAP COMMODITY PROCESSORS CLASSIFIED BY 1969 GROSS SALES
(Percent of Companies in Category - N = 578)

	1970 Gross Sales (Millions of $)									
Category*	Under 1	1-3	3-5	5-8	8-12	12-20	20-30	30-50	Over 50	Number of Companies in Category Sample
Aluminum Scrap Processor	18.1	27.8	19.1	13.7	6.4	7.0	2.0	3.0	3.0	299
Aluminum Scrap Smelter, Melter, Consumer	14.6	19.7	19.1	14.6	9.6	7.0	4.5	5.7	5.1	157
Copper/Brass Scrap Processor	17.9	27.5	20.2	12.9	6.3	6.6	1.7	3.3	3.6	302
Copper/Brass Scrap Smelter, Melter, Consumer	10.6	18.7	17.9	14.6	10.6	10.6	1.6	6.5	8.9	123
Lead Scrap Processor	17.5	30.7	16.7	13.2	7.4	6.2	1.9	3.1	3.1	257
Lead Scrap Smelter, Melter, Consumer	13.1	23.8	18.5	13.8	9.2	8.5	3.8	4.6	4.6	130
Zinc Scrap Processor	16.7	30.6	19.2	13.5	6.5	5.3	1.6	3.7	2.9	245
Zinc Scrap Smelter, Melter, Consumer	11.8	24.5	16.4	18.2	7.3	7.3	4.5	4.5	5.5	110
Nickel/Alloy Scrap Processor	16.2	28.1	19.0	14.2	6.3	7.9	2.0	3.6	2.8	253
Stainless Steel Scrap Processor	18.0	28.3	19.7	13.9	6.1	7.4	1.2	3.7	1.6	244
Precious Metal Processor	20.6	23.4	21.5	11.2	11.2	5.6	0.9	0.9	4.7	107
Gold Refiner	13.7	23.5	13.7	17.6	13.7	3.9	0.0	0.0	13.7	51
Silver Refiner	13.4	23.9	16.4	14.9	11.9	7.5	1.5	0.0	10.4	67
Platinum Refiner	8.5	19.1	14.9	19.7	14.9	8.5	0.0	0.0	14.9	47
Exotic Metal Scrap Processor	17.4	24.0	21.5	14.0	7.4	5.8	2.5	5.0	2.5	121
Paper Processor	29.8	42.9	8.3	7.1	7.1	2.4	0.0	2.4	0.0	84
Textile Processor	16.3	57.1	10.2	10.2	6.1	0.0	0.0	0.0	0.0	49
TOTAL ALL CATEGORIES	17.4	31.0	17.4	11.4	6.9	7.3	2.3	3.8	2.4	

* Row totals add to 100 percent.

Source: BCL - Secondary Materials Industry Census.

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Analysis of Business Statistics

Table Number	
A-11	Secondary Materials Industry
A-12	Commodity Specialty
A-13	Business Specialty.

TABLE A-11. SECONDARY MATERIALS INDUSTRY - REGIONAL TABULATION OF AVERAGE INDUSTRY BUSINESS STATISTICS

	United States Census Region									
	New England	Middle Atlantic	South Atlantic	East-North Central	East-South Central	West-North Central	West-South Central	Mountain	Pacific	National
Average 1969 Gross Sales* (N = 533)	4,612	10,345	5,402	8,301	4,333	7,273	9,941	5,031	4,321	7,540
Average Value, Plant, and Equipment* (N = 419)	755	1,835	1,087	1,903	1,740	1,106	1,057	1,112	1,105	1,480
Average Number of Employees (N = 554)	28	97	69	74	80	57	97	46	38	71
Average Investment per Employee*	27.0	18.9	15.3	25.7	21.8	19.4	10.9	24.2	29.1	20.8
Average Sales Per Employee*	165	107	78	112	54	128	102	109	114	106
Average Invesment per $ of Sales	0.06	0.05	0.04	0.04	0.02	0.06	0.09	0.04	0.03	0.05

* Thousands of Dollars.

TABLE A-12. SECONDARY MATERIALS INDUSTRY - AVERAGE BUSINESS STATISTICS TABULATED BY COMMODITY SPECIALTY

Commodity Specialty*	Average Investment in Plant & Equipment ($)	Average Number of Employees	Average Investment Per Employee ($)
Aluminum	1,739,000	66	26,200
Copper & Brass	1,863,000	98	19,000
Lead	1,652,000	95	17,300
Zinc	1,103,000	43	25,500
Nickel & Nickel Alloy	1,348,000	59	22,700
Stainless Steel	1,419,000	43	33,400
Precious Metals	3,270,000	49	67,000
Exotic Metals	1,508,000	39	38,300
Scrap Iron	1,638,000	82	20,000
Paper	870,000	42	21,000
Textiles	842,000	95	8,900
All Commodities	1,480,000	71	20,800

* Commodity specialty represents largest allocation of company employees.

TABLE A-13. SECONDARY MATERIALS INDUSTRY - AVERAGE BUSINESS STATISTICS TABULATED BY TYPE OF BUSINESS

Type of Business Speciality*	Average Investment in Plant & Equipment ($)	Average Number of Employees	Average Investment Per Employee ($)
Nonferrous Scrap Metal Dealer Processor (N = 199)	844,000	44	19,200
Nonferrous Metal Broker (N = 22)	745,000	16	46,600
Smelter and Refiner (N = 79)	3,122,000	97	33,200
Ingot Maker (N = 24)	2,915,000	112	26,000
Brass Mill (N = 5)	3,365,000	63	53,400
Scrap Iron Processor and Broker (N = 51)	1,836,000	88	20,900
Sweater (N = 0)	NA	NA	NA
Importer and Exporter (N = 17)	1,312,000	24	54,700
Paper Stock Dealer Processor (N = 37)	783,000	43	18,200
Paper Stock Broker (N = 31)	1,002,000	48	20,900
Textile Dealer-Processor (N = 24)	695,000	97	7,200
Textile Broker (N = 1)	NA	NA	NA
Textile Garnetter (N = 3)	1,675,000	262	6,400

* Type of business represents largest portion of company revenue.

SUPPLEMENT ON SOLID WASTE GENERATION AND DISPOSAL BY SECONDARY MATERIALS PROCESSORS

Solid Waste By-Products of the Secondary Materials Industry

As an addendum to the extensive survey, 307 of the firms sampled were asked to fill out a questionnaire on solid wastes generated as a by-product of their normal operations. The questionnarie, along with a tabulation of the replies is presented on the following pages.

An analysis of the responses indicates that general refuse, including garbage, trash, debris, and rubbish, represents the type of solid waste most generally encountered. The volume of solid waste generation is under 10 tons per month in many cases, and 50 percent of the firms report that generation is under 25 tons per month. Most firms simply haul the solid waste to the local dumps themselves or by a contract rubbish hauler, and 75 percent of the firms report that disposal costs average less than $500 per month, or roughly 0.079 percent of average monthly sales of $628,000. Thus, while the disposal of solid waste generated during secondary material processing may represent a physical problem, its magnitude cannot be considered significant.

RESPONSE TO QUESTIONNAIRE

CONFIDENTIAL

Addendum to Secondary Materials Industry Census

1. What are the solid wastes, by-products, and other residues of your plant operation that your firm generates and must dispose of?

Percent of Firms Responding	Type of Residue
40	Garbage, trash, debris, rubbish, skimmings, dust, refuse
16	Paper, cardboard, cellophane, cartons, etc.
13	Wood, wood containers
9	Scrap iron and steel
9	Slag and skim, fly ash, flue dust
8	Skimmings and drosses
7	Fibers, textiles, rags
6	Rubber tires
6	Insulation, wire insulation, cable strippings
5	Zinc oxide, zinc skimmings, zinc residue
3	Aluminum, aluminum oxide
3	Tin, tin cans, metal containers
3	Baling wire
Less than 3	All other including glass, brass, copper, lead, liquids, batteries, and brick.

2. How much of each kind does it generate? (List and give quantities.)

(154 replies)

Percent of Firms Responding	Quantity (tons per month)
27	Less than 10
23	11 - 25
18	26 - 50
10	51 - 100
17	100 - 500
6	Over 500

3. What methods are used to dispose of them?

(274 replies)

Percent of Firms Responding	Method
39	Hauled to dump
17	Sold
15	Used for landfill
11	Collected by private garbage disposal concern
5	Burn or incinerate
4	Dumped on own property
4	Recycled or reused - serves as a raw material
1	Stored on own property for resale
3	Other

4. What is the approximate cost of disposing of the above?

(Include collection, storage, treatment, and disposal costs.)

(187 replies)

Percent of Firms Responding	Cost ($ per month)
11	0
24	1 - 50
11	51 - 100
29	101 - 500
9	501 - 1000
8	1001 - 2000
4	2001 - 5000
4	Over 5000

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